

July 27, 1959

Aviation Week

Including Space Technology

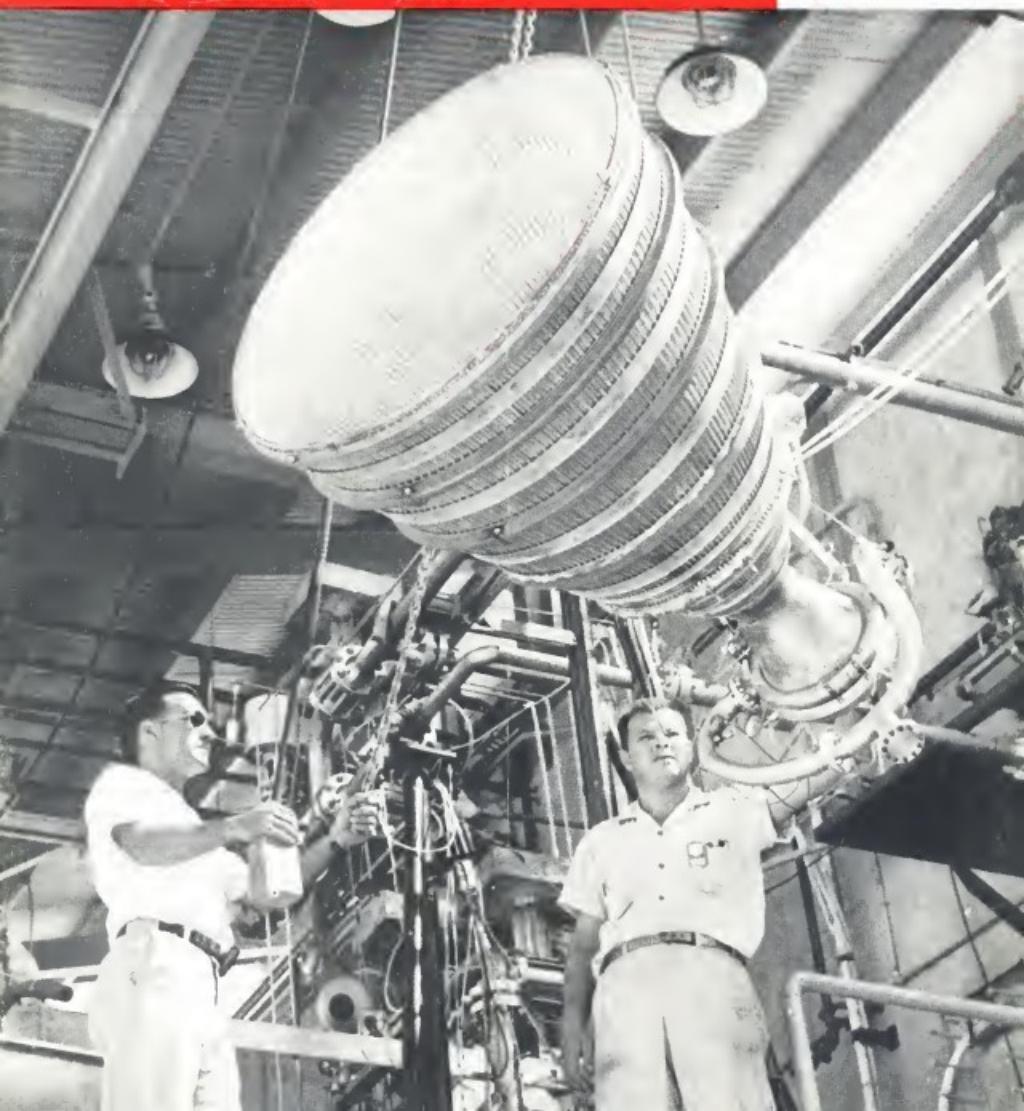
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- AO-1 Design
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The B-58, America's first supersonic bomber, is a product of Convair and more than 4,000 participating suppliers and subcontractors located in every part of the nation! This does not include the tens of thousands of companies who receive business from Convair's direct suppliers. At Convair-Fort Worth under the Weapon Systems Management concept, two out of every three dollars spent for the U.S. Air Force on the B-58 are paid to these supporting businesses for material and labor. In this, the American way, Convair, a Division of General Dynamics Corporation, has taken leadership for *minimum employment, for prosperity, and for peace.*



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PV012	.188	14,500	30,000	4.5	4.45	3.04
PV024	.367	21,000	8,000	6.5	4.53	3.13
PV039	.608	10,000	8,000	10.7	4.31	3.16
PV062	.950	8,500	7,000	14.9	4.04	3.19
PV104	1.880	7,500	5,500	19.0	4.65	3.58
PV105	2.500	8,500	5,100	20.8	4.60	3.00

*This is hydraulic output horsepower at 3000 psi.

The above table is important to anyone concerned with the selection of hydraulic pumps for future air or space vehicles. Note particularly the horsepower-to-weight ratios for both rated and limited life speeds. These are the highest known available at this time.

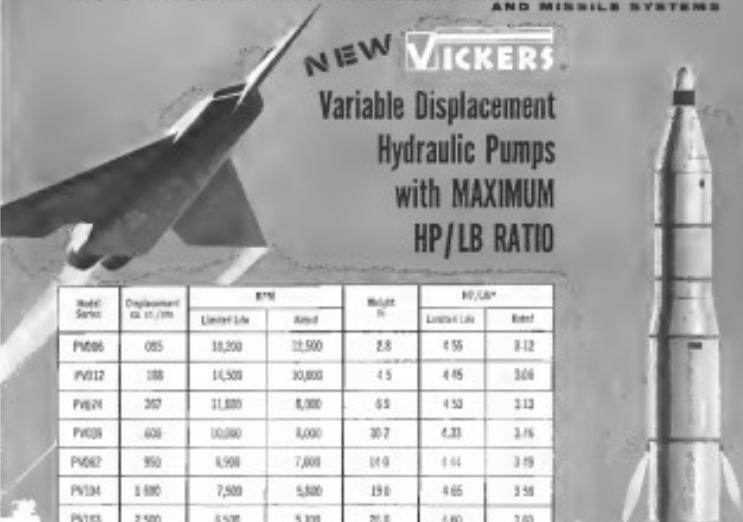
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An important fact is underlined here, that Kennedy
qualifies as a good writer in *test capability*.

AVIATION CALENDAR

- Aug. 5-Second Annual Western Regional Meeting, American Astronautical Society, Ambassador Hotel, Los Angeles Calif.

Aug. 5-7-William Frederick Densel Conference on the problems of hydrogen as a fuel for aircraft, Stanford University, Stanford, Calif.

Aug. 11-Third National Heat Transfer Conference & Exhibit, University of Connecticut, Storrs, Conn. Session Areas: Fundamentals of Thermal Engineering, American Institute of Chemical Engs.

Aug. 14-18-Wright Air Development Center Symposium on Aircraft Structural Fatigue, Wright-Patterson Air Force Base, Dayton, Ohio. Conference themes: 1. Metal-Element Interaction in Application of Vibration Analysis Studies 2. Metal Fatigue-Cyclic Stress Method 3. Fatigue Life Prediction Methods

Aug. 15-Fifth National Ultrasonic Symposium, Institute of Nonlinear Science, Polytechnic Institute of Brooklyn, Brooklyn, N.Y.

Aug. 16-18-Research Electronic Show & Convention, Institute of Radio Engineers, Con. Park, San Francisco, Calif.

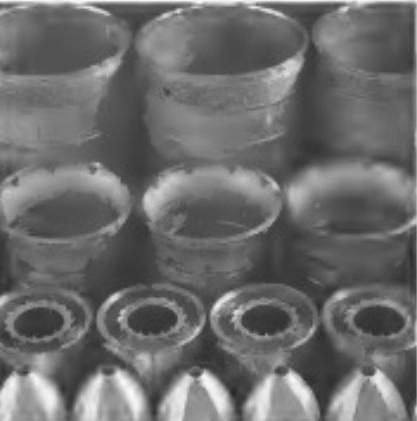
Aug. 17-18-19-AIAA/ASME Joint Evaluation of Space Shuttle Thermal Protection, St. Charles, Ill.

Aug. 18-20-International Symposium on Propulsion, includes the West Angeles and western deserts both from sea level and altitude.

Aug. 24-26-Mississippi Spaceport Symposium, American Rocket Society, Natchez, Miss.

Aug. 24-26-International Congress of the Aeronautical Sciences, National Spaceport Meeting, a conference on aerospace warfare, classified, San Diego, Calif.

Aug. 24-27-Fourth Symposium on Relativistic Metals and Semiconductors, Los Alamos, N.M., sponsored by U.S. Energy Research & Development, Space Technology Laboratories.



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Information about recommendations and choices of
the National Research Council's Committee on
Assessing the Health Effects of Environmental Pollutants
is available from the National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

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AVIATION CALENDAR

(Continued from page 5)

- Aug. 27-28—International Commonwealth Scientific Conference, Chichester House, London, England.
Aug. 28-Sept. 2—Annual Army Materiel Institute Seminar Program (AMIP), Research and Education Institute, Stetler Hall, Ft. Monmouth, N.J.
Aug. 31-Sept. 1—16th Annual Congress International Astronautical Federation, Chichester House, Westgate-on-Sea, Kent, England.
Sept. 1-3—Conference on physical chemistry in astronomy and space flight. University of Pennsylvania, Philadelphia, Pa.
Sept. 1-3—Post Office Office of Scientific Research and Development, G-1 Division, Washington, D.C.
Sept. 2-4—1959 Congress Engineering Co., Kettering, University of California, Berkeley, Calif.
Sept. 3-6—National Convention and Auto Show, New York City, New York, N.Y.
Sept. 5-6—1959 Farnborough Motor Display and Exhibition Society of British Aircraft Constructors, Farnborough, Eng.
Sept. 9—Mobile Mechanics Conference at Ford and Sohio Mechanics, Dallas area, Texas. Austin Tex. Sponsored AFOSR Department of Aerospace Sciences, National Defense Research Commission, Defense Science Foundation.
Sept. 16-17—Western Regional Meeting on Testimony on Science and Engineering, Institute of the Acoustical Sciences, Los Angeles, Calif.
Sept. 18-23—14th Annual Conference and Exhibit, Institute of Smith of America, Chicago, Amphitheatre, Chicago, Ill.
Sept. 21-22—Eight Annual Viscosity Study and Engineering Seminar on Technology in Service, Roosevelt Hotel, Baton Rouge, La.
Sept. 22-24—National Conference on Lubricating Oil, Atlantic City, Atlantic City, N.J.
Sept. 25-30—1959 National Conference on Lubricating Oil Applications and Maintenance, Hotel Sun Trust, Atlanta, Ga.
Sept. 26-27—National Seminar on Radar Equipment, Research Group on Space Electronics, U. C. Berkeley, Calif.
Sept. 30-Oct. 2—14th Annual Meeting National Aviation Museum, Air Museum, Dulles, Dulles, Va.
Oct. 3-7—Meeting on Angle Measurement Systems and Components, Institute of the Acoustical Sciences, New York, N.Y.
Oct. 5-10—National Aerospace Meeting Institute of Aerospace Engineers, Bu. Administration, Los Angeles, Calif.
Oct. 6-9—12th Annual Meeting National Space Society, Hotel Lorraine, St. Louis, Mo.
Oct. 6-9—International Symposium on High Temperature Technology, Andorra Can Adami, Canada. Maritime Province, Calif. Sponsored Standard Research Institute.
Oct. 8-9—Society of Experimental Test Pilots Meeting, on the Beach, Fort Lauderdale, Fla.
Oct. 10-11—Annual Ballistic Range, Edwards Air Force Base, Edwards, Calif.
Oct. 12-14—15th National Firestone Conference, Hotel Sherman, Chicago, Ill.
Oct. 12-14-15th General Convocation of the International Air Transport Association, Tokyo, Japan.

Spacecraft forgotton during the thumping ascent of a space probe rocket are methods of metaculus analysis, engineering and planning. The staff of Space Technology Laboratories is now engaged in a broad program of space research for the Air Force, the National Aeronautics and Space Administration, and the Advanced Research Projects Agency under the direction of the Air Force Institute Muscle Division. For space probe projects STL provides the total concept approach, including preliminary analysis, subsystem development, design, fabrication, testing, launch operations and data evaluation. The total task requires subtle original analysis in many fields as well as sound technical management.

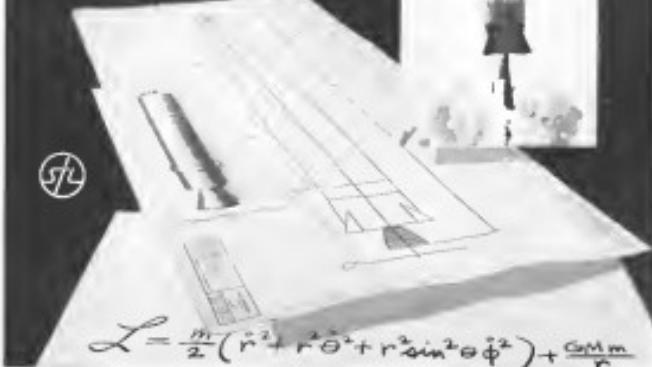
The STL technical staff brings to this open research the talents which have provided system engineering and technical direction since 1951 to the Air Force Ballistic Missile Program. Major missile systems currently in this program are

Atlas, Titan, Thor and Minuteman.

The scope of STL's responsibilities offers creative engineers, physicists and mathematicians unusual opportunities to see their ideas tested in working hardware. Inquiries are invited regarding staff openings in the areas of Advanced Systems Analysis, Rocket Propulsion, Space Flight Mechanics, Dynamics, Structural Analysis, and Aerodynamics.

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Oper. press. psi	6,000	6,000
Burst press. psi	24,000	24,000
Burst reduced at pressure	8	10

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NEWS IS HAPPENING AT NORTHROP



Radioplane drones shown left to right: XQ-9A; XQ-19; AP-720; QP-19; SD-2

RADIOPLANE CREATES FIRST FAMILY OF UNMANNED AIRCRAFT TO TRAIN

Radioplane is the world's leading producer of drones and space age recovery systems. As live targets, drones perform as aircraft—then can be recovered by parachute. As evaluators, drones simulate the appearance of the enemy threat while they score our weapon systems' effectiveness. On surveillance missions, drones are zero-length launched, fly cameras, take photos, and return with information within minutes.

Typical of the high-performance Radioplane target is the RP-76. This medium-range jet flight spans by altitude, speed, maneuverability, and it has the radar experience of a B-57 bomber.



MEN, EVALUATE WEAPON SYSTEMS, AND SURVEY ENEMY TERRITORY!

United States Army requirements for a surface-to-air missile target called for Mach .85 to .89 performance at 40,000 feet altitude. After an launch, the proposed target missile was to have a powered flight duration of eight to nine minutes. Under the direction of U.S. Army Ordnance, Radioplane produced the RP-76 target missile which has met or exceeded all of the performance specifications. Performance

of the complete RP-76 system, including flight operations, is particularly impressive in view of the anticipated low production and operational cost.

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Sharp new eye for navigation

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With the Ryan navigation, military aircraft and passengers can fly a new "electronic skyway" which provides precise separation between aircraft and the ground. The Ryan C W Doppler autopilot also allows safe right down to ground and sea level. These advantages accrue at take-off, climb-out, direct and landing as well as cruise.

Ryan's night prowess in electronics is creating new opportunities for engineers and technicians.

The Navy has selected RYANAV for installation in six major types of naval aircraft. They are already in squadron use in the Navy's fleet all-around with outstanding performance and are being learned in many aircraft and techniques, for low-level "dog fight" maneuvering.

Ryan's night side and verticals are found in the engine sections of RYANAV aircraft. They are the highest, simplest, most reliable, most compact of their type. They are setting new standards of economy, freedom from adjustment, and ease of maintenance, opening new fields of navigational possibilities, and reducing costs. Ryan electronic engineer recruitment is available upon request to those who wish to explore these areas.

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HEAVY DUTY CABLE/GROUND: Support cable assembly built and designed for hard usage at missile launching sites. Heavy duty moldings and a tough support tubing combine to resist wear.

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A semi-flexible cable with tubular copper inner conductor, foamed polyethylene dielectric and commercially pure aluminum outer conductor.

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Aircraft Radio Range Receiver

VINTAGE OF 1928



The late Admiral Byrd was equipped with the Model B radio range receiver.

the Smithsonian Institution in Washington, D.C.

The instrument sought was known as the "Model B", designed in 1927 and sold by the company as early as 1928.

The equipment was used in the old Pitcairn "Mailwing" model aircraft, used by N.A.C., which later became United Air Lines. It was also used on Colours between Boston and New York. In 1928 it served Admiral Byrd's first expedition to the South Pole in 1928.

The Smithsonian considers this instrument of significance in depicting the history of aviation and electronics.

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Your
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July 27, 1959

Aviation Week

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EDITORIAL

Possibilities for Gross Error

As the Berlin crisis festers like a boil, growing more and more close to erupting with the passing of each winter's days, in Geneva, the possibilities of a nuclear war through miscalculation become more likely. We know that the United States will not take the first step in precipitating another war, and we seriously doubt whether the leaders of the Soviet Union would deliberately take that action at this time if they were fully aware of its consequences. The great danger lies not in the malice of the current military equation between the United States and its allies balanced against the Soviet Union and its Communist satellites but rather in a major miscalculation of that equation by Nikita Khrushchev and his advisers.

It is difficult for people who have not visited the Soviet Union to understand how thoroughly the USSR controls all aspects of almost all Russian information about the rest of the world from the Russian people, including some of their leaders, and how long the oligarchs allowed a perspective to develop toward the Soviet viewpoint. This situation makes it impossible for the Soviet régime to get much realistic perspective on its position in the world. Arsenius Vinten in the USSR who has attempted to measure the most popular beliefs of life in this country with a view of creating quickly race to this mortal combat. The legal repressions on travel of Soviet citizens in non-Communist countries and the restriction of Russians travel to the U.S. to carefully screened official delegations is part of this déstabilized, almost pathological effort to prevent any element of reality regarding the rest of the world from penetrating to the Soviet population. At the same time, there is a tremendous dearth of knowledge of the outside world on the part of the Soviet citizen at all levels, as the visiting American will soon discover here he comes through the officially controlled channels.

With a consistently and deliberately distorted view of most everything foreign besides at the Soviet mind, it is hard to prevent even the highest levels of government from becoming partial victims of their own propaganda. This is where the real danger lies in the nuclear crisis and those that will inevitably follow.

Basis of the international intrigues, it is difficult to conceive of any other than the military strength of this nation as its determining factor in this question. Britain has recorded this same resistance by the German navy and by the Japanese, with the disastrous results, therefore also a matter of international record.

It is, of course, an occupational disease of a seaman to brag, but he always is sure he will get the mistakes made by his colleagues preposterously wrong. I have had to record who really did

It is apparent from Nixon's Khrushchev's unorthodox threat boasting of Soviet military might that he is threatening dangerously toward such a fundamental principle that no right makes a nuclear war now appear to be an attractive exchange. As Gen. Thomas Power, chief of strategy Air Command, emphasized as sharply as *Time* last spring (AW April 13, p. 21), it is really Mr. Khrushchev who is the vital judge of the United States' strategic deterrent capability—*not* the U.S. Joint Chiefs, Gen. Power, the Congress or the President. Only Mr. Khrushchev, however, appears to still believe that *now*, more

ment and his standards of disaster are far different than those in this country. Mr. Khrushchev is reported to have told Arnold Harrelson recently that he was prepared to lose Leningrad in a nuclear exchange with the West and refused to think that would be the extent of the Soviet damage. If this is true somebody had better get serious in Moscow about a real nuclear deterrent or we cannot stop nuclear warfare, regardless.

Here are some of the assumptions that appear to us in Russia as a result of their own control and off-line evaluation of information from the Western world. The tested and often strenuous debate over our defense program is interpreted in Russia as an argument over whether we will or won't spend a defense program or not. They apparently do not realize that the controversy is framed around the past and the future concern only the fate and scope of the defense program. They overlook the fact that we are spending about \$40 billion a year on defense and the debate concerns only whether we should add funds or cut them before

They appear to believe that the business and financial community is the Achilles Heel of the U.S. defense position and that the two lists of lowered costs due to a peace ultimatum⁴ that will reduce defense expenditures and big profits from trade with the Soviet bloc will prove irresistible to U.S. business and finance.

They have misinterpreted the innumerable political, executive and administrative changes in our defense program as a lack of genuine technical and industrial ability in the critical new fields of weapons technology such as missiles and space. As a result, they tend to overestimate the magnitude and possible duration of these responsible for lead in certain phases in these fields.

The tremendous promotion of their genuine scientific advances and the stagnation of all future research against strict rules of discussing success and failure with almost no room for error leads to the Soviet comes-a-visiting outside the technical circles who have better-a official distorted picture of their nation's capability relative to the rest of the world. Very little reaches the open mind about the genuine progress in weapons technology achieved in that country.

Because we often fail to back our "no retreat" military statements with what would be interpreted as an effective military preparation, the Soviets believe we don't mean what we say, and are only preparing retreat or compromise. The Soviet's public charge of "softening" if these preparations were made would be a small price to pay for their actual effect on Soviet thinking.

There is no doubt that the Soviet military position improved substantially in the past few years and the most technologized Western design of weapons has weakened. There also is a great danger that if we fail to accelerate and expand our weapons development programme to the new technologies we will face a positive critical advantage in the future.

But the greatest danger today and for the remainder of the century is the possibility of war based on a major misinterpretation by the Soviet leaders of our military capability and our determination to use it when necessary.

—Robert Hotz



From the Ford Trimotor in 1929 to the Boeing 707 jet of today, Kidde nacelle fire extinguishing systems have set the standard for the aviation industry. For thirty years Kidde has always been ready with lighter weight, more efficient equipment to meet the fire safety needs of ever faster and more complex military, commercial, and private airplanes. Actually since 1929, Kidde has supplied nacelle systems for 272 different models, built by more than 30 airframe manufacturers! At this very moment Kidde is developing still lighter weight, faster operating systems using new, more efficient fire extinguishing agents.



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Wellesley 4-Lorraine, Boston, Mass. - Montreal, Quebec - Victoria, British Columbia

WHO'S WHERE

In the Front Office

Edwin O. Uhl, vice president-financial administrator, has assumed control. Ed Uhl was formerly vice president of the Martin Co. and general manager of Martin's Vought Division, Orlando, Fla.

Mr. H. H. Hodges, president, Lockheed Aircraft Corp., and general manager of the Electronics and Avionics Division, Los Angeles, Calif., succeeded the late Louis N. Redden.

John G. McGuire, a director, North American Rockwell, Inc., Washington, D. C., Mr. McGuire, has been chairman and president of North Microtronics Corp. and North Ultrasonics Corp.

John E. Heslop, president, California Displays Corp., Inc., Burlingame, Calif., has assumed business, research, design, and quality control, as well as technical assistance, from John W. Gandy, assistant to the pres-

Charles L. Jones, executive vice president, American Electronics, Inc., Los Angeles, Calif.

Ronald A. Kline, a divisional vice president, American Micro Products, Inc., Los Angeles, Calif., Frederick C. Kline, Mr. Kline continues as director of AMI's General Processing Laboratories, Glendale, Calif.

William T. Marz, senior vice president planning, operations and industrial sales, International Telephone and Telegraph Corp., New York, N. Y., T. Vic Hoyer G. Engle, vice president manufacturing and facilities.

Hughes Aircraft Co., Culver City, Calif., has announced the following appointments: John H. Richardson, director of marketing; Charles W. Morris, manager, International Division; John W. Johnson manager, test equipment and consulting services; and Robert R. Smith, David A. Hill, manager, Hughes' State Defense, Calif.; Rayburn Conley, John L. Woods, manager of the company's Washington, D. C., office.

Robert H. Knobbe, divisional manager in AC Division, Flying Division of General Motors, Elgin, Illino.

Honors and Elections

Gen. L. A. Atch, president of KLM Royal Dutch Airlines, has been elected a member of the International Advisory Committee of the Safety Foundation, Inc., New York, N. Y.

Clement Zorn, director of the Wiesbaden Electric Corp., seventh Infantry, has been elected to membership in the American Academy of Sciences for "the distinguished and sustained achievements in original research."

Eugene McDonald, supervisor of packaging and packing for General Electric's Heavy Military Electrical Department, has been named chairman of the Packaging and Packaging Division of the American Association of Packaging Engineers.

Heinrich H. Maister, general manager of Repubblica Autonoma d'Altopiano Venosta, has been made a Knight in The Order of Merit of the Republic of Italy for "his contributions to enhancing the activity of Italy's tourist industry."

(Continued on page 93)

INDUSTRY OBSERVER

► Proposals for ground and orbital stations for Air Force's new air launched ballistic missile, Ws-11A, will due last week from various manufacturers. Douglas Aircraft Co., at the ALBM prime contractor, will evaluate proposals, then recommend its choice of system manufacturer for final Air Force approval.

► Elapsed Custer missile used in National Aerospace and Space Administration's Little Jet test vehicle (AW July 13, p. 18) differs from Thor-Mark I in that it is slanted outward and expanded slightly to give better acceleration at altitude at sacrifice of weight, case and boosters differ; propellants are slightly different chemically. Custer is roughly the same weight, diameter, length and performance as Sergeant.

► Douglas El Segundo Division has a Navy development contract for a target detection system under study by the company but some basic design is based on the effective use of its AWD Starburst and other attack craft until enough information is gathered.

► New larger Air Force will place an order for the Grumman A-3W "shov" attack plane designed to Navy specifications to fly at speed of Mach .9 at sea level for use by USAF's Tactical Air Command. An Air Force order for the aircraft designed to escape radar detection by flying close to the ground would not just save, permit the Navy to acquire some aircraft with the funds it has spared for the program.

► Pressure in the pure oxygen atmosphere of the Project Mercury capsule will be 5 psi equivalent to the pressure at about 25,000 ft. altitude. Pilot gas on oxygen when he is put into the capsule about an hour before launch and keeps the free play of his pressure suit closed. Pilot can remain open during orbital flight but is closed again for reentry phase. Suit is sealed by a water bath and refrigeration cycle. Suit and capsule are a common environmental system, but the suit also has its own emergency capability.

► Mercury capsule recovery and systems are being tested by dropping capsule models at sea off Florida, Cape Canaveral and Mayport, Fla. They are intended to be the same Navy units which will do the actual recovery job when the Mercury capsule returns from orbit.

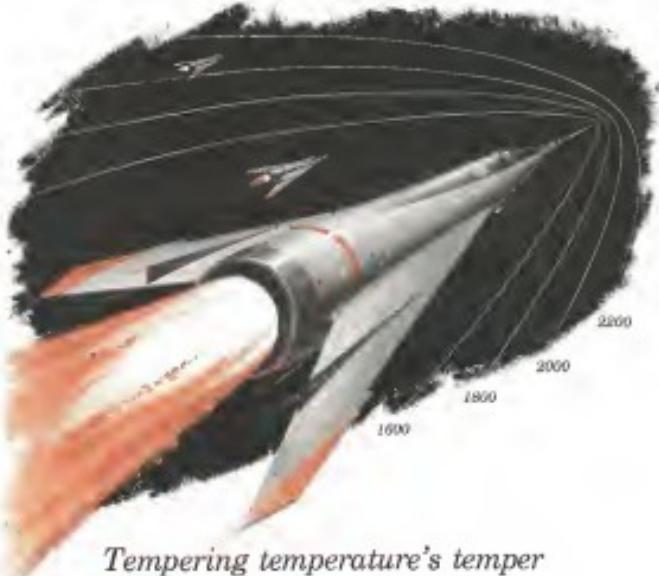
► Massachusetts Institute of Technology has a contract for a stability study in connection with Air Research and Development Command's WS-117L advanced reconnaissance version.

► Fracture of a proton ring ring on one of four fast-start exhaust nozzles caused failure of the Northrop-Lockheed Polaris AX-11 test vehicle at Eight KW July 20, p. 28. Shock of initial acceleration broke off a six-pipe piece of one proton ring. Vehicle managed to progress even into trajectory but was not able to stabilize course after a wind shear deflected it. Missile was destroyed by ground control shortly after ignition of second stage.

► Honeycomb sandwich structure using 3-DIM is thick sandwiched foil or core between two sandwichlike face sheets with a thin, tape protective coating on one side with about 2,000 ft. per sq. in. up to one hour with one end insulation in cooling. Sandwich was built and tested by the Naval Division of Northrop Corp.

► Bid will be opened this week in the award of contracts for construction of shelters and launch facilities for the Air Force Boeing BOMARC ground-to-air interceptor missiles to be based at Strategic Air Command's Vandenberg AFB, Calif.

► Lockheed M-24 vertical supersonic STOL, being tested by the Army has been completed and is now undergoing final climbout and reentry tests prior to the beginning of combat flight testing at the company's Hagerstown, Md., pilot-seat test site. Control surface features will cause pilots to keep the horizontal tail flat that can be tilted and rotated at different speeds.



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Washington Roundup

Kern Boosts Nuclear Plane

U.S. could put a nuclear-powered testbed aircraft into the air four years if the necessary funds were made available now, Maj. Gen. Donald J. Kern, chief of the Air Force-MEC nuclear aircraft program and his work to its strategic stations thus far in support of the "80 early development concept for the atomic plane."

Kern's position has not yet been taken at hearings of a subcommittee of the Joint Congressional Committee on Atomic Energy, in which concern over the Administration's "go-slow" policy of flying a nuclear aircraft only after its engines can exceed the performance of chemically fueled aircraft advanced in Dr. James Killian who is now being tested in the President's scientific advisory panel made little to Gen. Kern's surprise.

- Major objective of the JCCAE is to develop a direct rock-to-rock propulsive system similar to the one under development at General Electric. Gen. Kern's office does not want to wait for the availability of "full-spectrum aircraft" and believes a long-tested one like the existing reduced-temperature core will expedite development of a nuclear weapon system.

- Preliminary design studies of nuclear cycle nuclear propellants under development by Pratt & Whitney Division of United Aircraft Corp. and now under Navy expression, have shown that there is a possibility of achieving the necessary thrust-to-weight ratio for high altitude, supersonic flight on nuclear power alone. This ratio is not so advanced in the direct cycle engine, and no mass rebalance could be attached to its development. It is considered promising, however, for the construction of a nuclear-powered aircraft of the B-70 type.

- Agreement was reached in 1955 between Kern and Adm. James S. Russell, then chief of the Bureau of Aeronautics, that Navy participation in the B-70 program would not "generate into competition" in flight. The Navy requirements as an aerospace aircraft, he said, is a test bed of present through the use of the indirect cycle engine and a test type aircraft which is heavier than that required by the Air Force but has all of the aircraft's equipment and personnel from existence.

- Air Force pressure for establishing weapons and equipment requirements has changed during the last six months. Presently, the earliest general management proposal presented under General Operational Requirement No. 1. The Air Force uses this requirement as Weapon System WS-100A. Now the Air Force and the Air Force are in the process of updating General Operational Requirements with other Specific Operational Requirements or System Development Requirements. The specific requirements are organized in merit "matrices," much of the Air Force for weapons systems are grouped compatible with the state-of-the-art, and a production program is contemplated.

- Gen. Kern believes that the nuclear aircraft program will help fulfill the earlier strategic System Development Requirements which describes in "general terms the characteristics of a nuclear aircraft required for the attainment of a limited operational capability," requirements presently beyond the technical state of the art.

- Kern also referred his charge, of test pilot that the present lagging position of the U.S. nuclear aircraft program is the responsibility of top Administration officials (AW May 24, p. 27). He said "You will note that there

has been a fluctuation in flight testing philosophy brought about by decisions at the Department of Defense level, but these have been no changes in the technical direction of approach of the propulsion industry."

Procurement Policy Review

Major review of defense procurement policy authorized by the law extending reorganization (AW July 9, 1961) will be carried on separately by House and Senate Armed Services Committees. The Senate group, named last week, is headed by Sen. Strom Thurmond (D-S.C.), Sen. Edward G. Boland (D-Mass.) and Sen. Edward Kennedy (D-Mass.) and Sen. George Smathers (D-Cong.). The House Armed Services group (AW July 22, p. 24) is headed by Rep. Carl Vinson (D-Ga.) who has led congressional opposition to recursive type contracts extensively used in aircraft and missile procurement.

GAO vs. Soltostoll

General Accounting Office is putting up formidable opposition to the proposed of Sen. Everett Soltostoll (R-Minn.) to cut back use of recursive weapons by forcing ever more contracts to a single prime contractor through maximum price contracts. GAO had in a report to Congress:

- A single weapon prime contractor could attain "an dominant position with respect to a cost weapon system, and the military department has such control that it becomes almost completely dependent, as a partner, upon the contractor. This could seriously impair the military department's ability to discharge its basic mission."

- "Emphasization of recursive type contracts would" is cause the service to higher profits and erode price negotiations more difficult. Let us see an atmosphere that it could easily result in contractors to be efficient in low cost producers."

- GAO called for "effective competition" through design, research, and development as well as production type of weapons systems contracts. This GAO recommendation would do away with sole source as well as costs and advance the state of the art than the Soltostoll proposal.

707 to Moscow

Pan American's first Boeing 707-371 intercontinental turboprop jet took 819 passengers and crew members nonstop from New York's Newark in 3:36:45 min. As compared with previous record of 9 hr. 45 min set 10 days earlier by the Pan Am 747-100 turboprop transport (AW July 13, p. 37). The U.S. aircraft was originally scheduled to carry Vice President Nixon and his party plus 16 members of the press to Moscow for the official Russian visit due a few minutes past 10 in the evening of July 18. The 707-371 was composed of an original group of 10-12 new from Boeing to Moscow with a refueling stop at Respublik, located in a Military Air Transport Service V.G. 157—military designation for the Boeing 707-370.

—Washington staff

Navy Bids to Capture Major Space Role

Three-service 'military space command' proposed; plan may touch off new Defense Department row.

By Craig Lewin

Washington—Navy is making a bold bid for a major share in U.S. military space programs with a proposal for a joint military command to run space operations.

Under the Navy proposal, a Military Space Command would be established to run space system operations, with the Defense system assigned equally among the three services for actual operations. This would assist the Navy and Army in equal share with the Air Force in the military space program. The organization would be run on a rotational basis, with each service taking its turn in command.

The plan is currently under a joint proposal by the Joint Chiefs of Staff, led by Gen. Alexander Haig, Navy campaign for a major share of space programs, and it may be one of the opening gambits in a race of the inter-service power struggle, which potentially flows up to the Department of Defense.

Pressures Mount

With Navy and Army functions increasingly confined to the limited war and peace mission pressures are mounting for a means of giving the two services significant roles in the space field which is increasingly dominated by the Air Force. The Navy proposed would accomplish that, but the Navy and Navy have a present concern in their future roles after they end as the Joint Chiefs of Staff.

Navy has been trying for several months to upgrade its own space effort into a single integrated program but final arrangements have not been re-

ached from the National Aeronautics and Space Administration. The conversion also would have a security advantage.

The agency could take the Defense Department organization and direct command of the Joint Chiefs of Staff as its senior staff and corps members and SAC. It would also take the other joint commands, however, in its station command. This would have considerable fanfare because of the size of the service.

Staff Organization

Staff organization of the space command would include such divisions as support, communications, logistics, procurement and policy. Major elements of the operational organization would include launch support and tracking, satellite and instrumentation. Under this last rubric would come the Defense Meteor Range, Atlantic Missile Range, White Sands Missile Range, a tracking and surveillance coordination center and additional forces and facilities which might be assigned to the command.

Each of the missile ranges would be under command of one of the three services. The tracking and surveillance coordination center would be jointly used by the Army space command, except that each would retain separate tracking and surveillance coordination centers under its own command.

Possibly, the Military Space Command could take the lead of operating space weapon systems, along the Strategic Research Projects Agency's and other organizations lead finished development work on them. The command's space capability would include such vehicles as maneuvering attitude satellites, orbital debris communication sites and atmospheric warning and environmental satellites.

Navy authority dealing the space command proposal is the chairman of a joint committee of military space members to the senior military officials. This committee Navy says might range from Strategic Air Command to various strike forces and Army strategic forces, although the members of interest may or may not serve among the members in the functions of the organization using them.

Another argument is that the joint space command would assist the U.S. in an early expansion of space exploration projects.

Chairman of faculty deployment is a letter sent to the Navy against its being on the committee that a joint committee would ensure that all joint programs would receive a joint congressional budget. An Air Force letter to the Senate Armed Services Committee says the committee's budget would be a plus when an enriched air capsule and crew operations should be established.

Joint operations are cited as further advantages.

With the proposal in its early stage of formulation, it is difficult to determine what the space command's administration would be like initially against its congressional supporters. There is considerable resistance to the proposal by the present congressional organization of the joint space group. NASA is anxious, and a powerful Senate committee whose chairman might be inclined to oppose some aspects from NASA. The presence of as NASA depth in the proposed tenure of the Military Space Command's take of organization would seem to indicate at least some convolution between the two groups.

Even within the Defense Department there is some question concerning the extent of space operations the Military Space Command would run. It might be confined to initial operations of a flight control or reconnaissance ballistic missiles which operate largely in space during their lifetime. In this case, the flight control would be the choice of the U.S. since this job is increasingly becoming involved with space operations.

Such enlarged authority could easily upon the present operational roles of such groups as SAC and North American Air Defense Command and then create another roles and mission intrusions. As present considerations might dictate that all these global jobs be retained in a national space operations unit that would cover all fleet jobs was operations.

The Navy idea of dividing space operations equally among the services to reduce the cost of launching and maintaining enough weight in Air Force planes and space debris distrust from USAF can be expected if Defense Department considers before anything else the nature of a Military Space Command business a reality.

An Army space satellite system, as well as other services, should be operated by the service with a primary interest in those units rather than arbitrarily parcelled out on a sharing basis. Currently, these space nations are handled by their primary user and USAF would like to see this that way. Many times the status quo, of course, would remain, as Air Force dissatisfaction of space operations.

Joint space operation also runs against the USAF philosophy that acting on an arbitrary border between the atmosphere field of naval Air Force operations and a space area for joint command is nonsense. An Air Force letter to the Senate Armed Services Committee says the joint space will be expanding outwards with technological progress, not a plus when an enriched air capsule and crew operations should be established.



First Drawing Shows Corvus Configuration

First review of Texas Corvus, Navy's new experimental orbital guided missile has been completed for the last test over Pacific Missile Range set to next week at Naval Missile Center, Pt. Mugu, Calif. Powered by a solid rocket motor developed liquid propellants (AVN April 26, 1968, p. 21). Corvus is a test of the carrier-based aircraft and is designed as a cruise missile. In its most basic form, it is a boosted airframe for the carriage of this missile. First launch was from Naval Research Lab., Ft. Detrick, Md. The initial launch plane of the Corvus program was selected in a comprehensive preflight and successfully inspection at the Texas plant where a Navy team of over 50 specialists reviewed results of extensive ground tests of Delta and of Pt. Mugu. Major subcontractors to Texas on Corvus include: Reaction Motors Division of Thiokol which developed the paragraph liquid rocket engine; Texas Instruments, Dallas, Tex.; W. E. Morris Corp., New York City; Williams Co., Milwaukee, Wis.; Haskins Motor Associates, Torrance, Calif.; Douglas Aircraft Co., Santa Monica, Calif.; Belfort Research Laboratory, New York, and Fazio Engineering, Mass. Ave.

Although these test have some relevance of battles being fought in the isolation of space, USAF regards this largely as a probability of the future and maintains that military problems and operations must be considered in a tactical context. The use of first argument is that the area to be attacked is so small and so far away that the number of targets can hardly change space as their location, then objectives are nil.

Proposing a joint space command is a reversal of the trend of the last few years, and though the type of leadership envisioned in NSC would seem to be a model more of maintaining separate service identities in a new field than at blending the three services into a single work ing organization.

Distraction toward the target in engi-

nering papers rather than the means of delivery is the basis of the USAF pro-

Engine Malfunction Grounds 540

Washington—Allegheny Airlines Inc. will be forced to ground its fleet of the Canadian SHL turboprop transport from scheduled service because of severe malfunctions in the engine bearings, the airline said.

The airline is leasing the engine from Canada for a three-month period in attempting to determine whether the engines were being damaged by truck or road shock during shipping from New York to Washington. The engine, which came from Germany, has been shipped from England and will be handled separately en route through to Washington. Meanwhile, a full evaluation of the bearing problems will be made before the planes are put back into service.

Allegheny began service with the Canadian SHL 101 C, with one main trip link between Washington and Atlantic City, and three round trips daily between Atlantic City and Pittsburgh. Offshoots of the aircraft's average flight and one-half hour with all passengers maintained, and overall accomplished between 10 p. m. and 6 a.m.

Navy ANP Contract to Martin

Washington—Navy's Bureau of Aeronautics is awarding the Marine Corps a \$127,800 contract to the Sheldahl Division of Martin Marietta, Inc. for a research project to develop an airborne weather system.

The major portion of these funds will go to that A. & W. Marine Division of United Aircraft Corp. for the further development of an airborne mobile weather system using liquid fuel at a fixed altitude and with a heavy load located completely around the sensor to protect both the sensor equipment and crew from radiation from the aircraft. Sheldahl also has the responsibility of installing a self-deploying lighter in the aircraft.

Sheldahl's philosophy of developing a workable cargo below proceeding with elaborate and difficult design work has been utilized in the design of the Vought V-100A. Vought's design effort, after much negotiation by Sheldahl, follows the pattern set by Vought. Mr. G. R. Reiley is the developer of weather instruments. Heretofore experts that the weather system will be in 1969.

Sheldahl has received a total of \$107,800 to develop weather systems studies since 1964, but the new contract for \$127,800 is the more specific or focus of the aircraft design and intent to be available.

DUAL XLR115 hydrogen rocket engines test stand at Pratt & Whitney West Palm Beach, Fla., facility, with main engine option in foreground.

Space Technology

Centaur Space Engine Components Fired in Test

By Everett Clark

West Palm Beach, Fla.—Hydrogen chambers for the first U.S. liquid hydrogen rocket engine have been built. Following early spring in the rapid development of a two-stage powerplant that already is earmarked for a launch of scientific military and civilian space missions.

It is not known whether the complete 15,000-lb-thrust engine, designated XLR-115 P.U., has been tested in the full-scale version but all compo-

nents have been tested either in full or small scale form.

The XLR-115 P.U. including pump, control valves, nozzle, injector plate, etc., is being developed by Pratt & Whitney Aircraft, Florida Research and Development Center at the cost of a fourth of propellants that currently will last three of 500,000 lb or more.

Two XLR-115 engines will power the Centaur Centaur upper stage, which will be used by the Air Force as a communications satellite launching vehicle.

In National Laboratories and Spain, Aluminothermic for solidifying space probe, lunar descent modules and main engines, is being developed by Pratt & Whitney Aircraft, Florida Research and Development Center at the cost of NASA for the Saturn space vehicle.

The support was of liquid hydrogen as a spur fuel on the very short duration of the research center, with its 17 engineers learned hydrogen engine and component test stands, and the multi-ton capacity USAF An探针 facility. Liquid hydrogen production plant next door.

The four-hundred-engine test stands built by Pratt & Whitney stressed its thrusts of up to 100,000 lb. A larger number of test runs under construction are anticipated as a single, open check. It is being performed now by the company and the government. Many higher thrust advanced models of the XLR-115 already have been designed in detail.

The planned XLR-115 will be used only by one of the Centaur stages. This will weigh pounds full oxidized but allows the stage to be shorter because of lighter than if a single thrust division were used.

Centaur Stage

Centaur stage will be 10 ft in diameter to fit the modified Centaur Aids that will serve as a first stage. Although the Centaur stage will weigh about the same as the Vega liquid oxygen tanks, upper stage planned for another altitude outside of low orbiting, about 40% over the most advanced



VACUUM CHAMBER under construction at stand that will pressure test of multiple XLR-115 engines in simulated space conditions. Various support systems are used to evacuate airless behind nozzle with vacuum chamber.

Thrust capacity is 330,000 lb each.

Test Program

Vega stage because of hydrogen's greater specific impulse.

The XLR-115's thrust can be increased beyond 20,000 lb using combustion with the same hydrogen. Perhaps, with no mix. The engine can be shut down and restarted at ease. Since the engine is to be used outside the atmosphere, its nozzle is made of stainless steel and strong regenerative cooling has a very large expansion ratio, which appears to be about 40.

Extremely low temperature of liquid hydrogen (-423°F) requires that mass amounts of lengths of the exhaust must be used for gasbushing the XLR-115 in case the engine fails while the engine is very cold. Use of the hydrogen for regenerative cooling of the nozzle means that the nozzle actually shrinks during firing.

Although the engine is a complex, flight design, and not an engine of existing design, its great design and performance is believed to be quite similar to engines using conventional propellants.

Simulated space conditions for engine testing are created by firing into a nitrogen divergent supersonic diffuser which is first expanded to 0.16 in. of diameter absolute by means of a piston-type shock expander. Steam is heated in superheated water at 250 psig and 100°F . Steam flow rate is 2,900 lb/min at 100 ps. Tipping system is held in bands on the order of 10 sec. Sequence includes firing of the steam ejector, activation of the engine's electrical ignition system which ends the main stage valves and fire the engine until the atomizer system is over at over at the chamber



TEST STAND reflects use of open construction with diagonal roof to prevent spark escape of pressurized hydrogen in case of fire. No insulation equipment is installed overhead. Below, two XLR-115 chambers are visible at the bottom of the stand. Engines use regenerative cooling. Extremely low temperature of liquid hydrogen even during combustion prevents issues such as shattering during firing.



but first. Fuel for both is pumped from a 2,000-ft tank in a carbon-polymer probe from the Air Products plant.

Difficult for a long, double-walled, water-cooled vessel of stainless steel through which fuel flows at 10 ft/sec, is the use of about 500 ft of and less than one mile of piping.

"We have had the same basic system prove the best fuel storage in the earth two and a half years and a second well serve the two north area tanks, which will be in operation within a few weeks."

Next step will be to place the complete engine in a chamber so that the engine as well as the exhaust stream can be evaluated against environmental. This chamber is being constructed now at the tank site.

Despite the watch held over that liquid hydrogen is a difficult dangerous fuel to handle, Pratt & Whitney project personnel express extensive confidence in the science and art that it can be stored, handled and used.

The confidence is based on having

used several million gallons of hydrogen in development work since 1956, compared to what the company believes is small-scale use of thousands of gallons by its competitor. (This experience with hydrogen was described and set forth in ARS earlier, see below.)

"We believe that our experience at actual hardware development and flight vehicles, compared to the Johnson Space Center, has been far more extensive than that of ARS," says KLR-115 project engineer Bob McNeely. "McNeely and many other project engineers come to Florida in staff the test research center but are also experienced in hydrogen research and development work with Pratt & Whitney Aircraft Division and the project company, United Aircraft Corp."

United's Research Department began work with hydrogen as an aircraft fuel only in 1955 under a Wright Air Development Center contract to conduct gas-phase combustion characteristics and performance with various oxidizers. These

After considerable small-scale test work with fluorine as an oxidizer, Pratt & Whitney has reported its first use of liquid oxygen for the XLR-115 aircraft they feel its convenience, however, etc., outweigh its flight propulsive advantage.

After considerable small-scale test work with fluorine as an oxidizer, Pratt & Whitney has reported its first use of liquid oxygen for the XLR-115 aircraft they feel its convenience, however, etc., outweigh its flight propulsive advantage.

■ ARPA contracts awarded since last fall for the development of high energy solid propellants are aimed at obtaining warheads with specific capacities of 250 kg according to Dr. Alan John E. Clark, ARPA deputy director.

■ Under assignment from the Secretary of Defense, ARPA has initiated a broad program to basic research in sea level and altitude performance of solid propellants.

■ Studies of hydrogen as a rocket motor fuel have been made by the National Materials program, which will be continued to encounter in the hope of increasing the overall number of graduate students.

■ ARPA has issued three 50-upgrade grants, now going into ballistic missile defense programs, some of them looking at boost in 1984. Alan Clark also pointed out that the nuclear-powered SR-71. The most common solid fuels with government funds will have to meet requirements in certain areas for the modulation of materials in time of war.

One of the biggest difficulties to overcome in the use of liquid hydrogen has been the fear of fire and explosion. National Aerospace and Space Administration may go to the same area for the same purpose but has not definitely decided yet.

■ Gte Mathematics has developed still another highly energetic fuel, HEP-5. Its future, like that of HEP-3, lies in approval of the fully designed Ar-

bus turbopump. Liquid hydrogen was black oil-like gasoline on ice, to set the carb. Stills at rock to break the material across the United States.

Part 2. What has undoubtedly had some importance in handling liquid hydrogen in connection with flight development there are other reasons:

the use of liquid hydrogen and liquid oxygen in combination with the use of liquid hydrogen, liquid nitrogen were considered the most critical.

In experiments carried out in an unlined series of Cape Cod, Mass., as mentioned, that spilt liquid hydrogen rapidly vaporized and mixed with the surrounding air, and that this mixture will burn readily and rapidly, but will explode only if ignited by a spark, such as from static electricity.

Further, they found that the flame from the liquid hydrogen will not propagate through insulation, the fuel and flame, going directly straight, and is not greatly affected by external winds. Other significant findings were that liquid hydrogen contains much more graphite from a bed of crushed stone than does solid and that it takes a shock wave source such as a blasting cap to cause the liquid hydrogen to undergo a relatively detonative rather than burn.

As a result of these experiments, an investigation disclosed that most of the heat transferred to the liquid hydrogen to the insulation of the liquid hydrogen along with the resultant quick propagation was evaporation. Also, they found that they concluded that 60 ft was a safe separation distance for liquid hydrogen tanks that can store more than 700 gal of liquid hydrogen per unitary storage head area of over 15,000 ft².

■ Due to its low density, hydrogen can be transferred through pipelines at very high velocities and with low friction losses. In the liquid-hydrogen transfer between the Air Products and PFW plants, hydrogen moves along at the rate of 400 rpm.

■ Pumping of hydrogen is a prerequisite to the startup use of liquid hydrogen as a rocket propellant. Pumping must be done at short periods of time. At Alford Chemical and the Chemical Mfg. Manufacturing Systems of Edwards AFB Rocket Engine Test Laboratory, in an isolated series of Edwards AFB orbit, Herkules, Bette, large quantities of pure hydrogen were produced, split in a test pit. Ignition was spontaneous. During this ignition work, Alford Chemical's line, which is unable to produce liquid hydrogen from cryo, or natural gas, was successful less than 55%. While this is not clearly when compared with the kerosene-type fuels that were going into most large U.S. rocket liquid-hydrogen gas is not intended for routine missile applications.

Currently liquid hydrogen is being tested in series tests in 6,000-gal tritankers with each tank separated from the others by a thin wall. Use of diisobutyl carboxylate (DIBCO) reduced the range slightly to 1 sec while a water leg hydrodynamic test up to approximately 150 ft, as noted N.J. Vondervisch and D.B.P. Kellar of Edwards AFB. The amount of water and hydrogen is important. If too much is used, it will spill with the hydrogen igniting as it comes back to the ground. They also found that a small auxiliary station is necessary to a thermal test who promote to prevent wind distortion.

use by fast a torque, no liquid fuel and then heat it to a gas. This led PFW to the conclusion of an elaborate heating system which is no longer required.

■ Present requirement in all hydrogen test stands, namely Robin, is adequate combustible. Before, hydrogen gas was quickly and incendiarily trapped into pipe type rock, PFW & Watson stands have short tanks and breath on an auto wall.

■ In tests involving liquid hydrogen, note includes the test stand is operated from a control room 900 ft away.

■ Control rooms are surrounded at slightly greater distances to prevent heating gas from entering. Inside of the control room ventilation system is low flow and at least 100 ft from the test stand, generally ground.

■ Liquid hydrogen tanks are rarely detected owing to the formation of ice crystals and water vapor around these PFW combustion tanks in the presence of liquid looks over other, this has been caught as a liquid as the flame is an open air and not endangering other parts of the system.

It does not work with materials normally found around test stands include iron and things iron and iron oxide. It does not detonate or decompose in long-time storage. It is not explosive nor oxidizing and does not react. The most principal processes in handling liquid hydrogen tanks that are mentioned are grinding against oil, possible ignition sources and against impact point of the fuel.

■ Ignition of hydrogen's high energy potential partner liquid fluorine is the most significant aspect, perhaps was that on the test pit. Ignition occurs with fluorine spills caused due to Alford Chemical and the Chemical Mfg. Manufacturing Systems of Edwards AFB Rocket Engine Test Laboratory.

In an isolated series of Edwards AFB orbit, Herkules, Bette, large quantities of pure hydrogen were produced, split in a test pit. Ignition was spontaneous. During this ignition work, Alford Chemical's line, which is unable to produce liquid hydrogen from cryo, or natural gas, was successful less than 55%. While this is not clearly when compared with the kerosene-type fuels that were going into most large U.S. rocket liquid-hydrogen gas is not intended for routine missile applications.

■ On the PFW test stand, the rocket engine gas turbine pump hydrogen gas through from 5,000 gal. Between the test chamber, van Buren, must be supplied with hydrogen at a pressure equal to the engine pump discharge pressure.

■ All test stands are insulated with nitrogen and hydrogen. For pumping and pressurizing liquid into gas for cold starting and pressure testing and liquid oxygen for combustion. Liquid oxygen is supplied to the engine from a master located on the opposite side of a burner from the fuel source and lines.

■ Liquid hydrogen tanks and lines are connected to a test stand test system which means excess hydrogen in a simple vertical tank with with a porous graphite on top located in a corner, porous. Porous if was considered never

Space Technology

Liquid Hydrogen Nears Operational Status

By Michael Tolifer

Columbus, Ohio—Liquid hydrogen is now ready to take its place as an operational propellant, scientists and engineers learned at the American Rocket Society's propellant thermodynamics and handling conference at Ohio State University.

The audience was told what happens when large quantities of liquid hydrogen are spilled and ignited and how the resulting fire differs from conventional diagnostic equipment used to handle liquid hydrogen that is fast if not explosive enough to be used in space.

Other information that came in light both inside and outside the meeting rooms included the following items:

- Hydrogen's high energy, nonflammable, broad flame and its comparative brittleness (different but not new) can afford safe handling at isolated facilities where there is probably large enough to meet the minimum requirements of just one IBM test code.

- Researchers at Edwards AFB have selected an isolated section of Edwards AFB as the site for two large-scale hydrogen rocket engines. National Aerospace and Space Administration may go to the same area for the same purpose but hasn't definitely decided yet.
- Gte Mathematics has developed still another highly energetic fuel, HEP-5. Its future, like that of HEP-3, lies in approval of the fully designed Ar-

Blue Streak Keys British Space Effort

By Cecil Brownlow

LONDON—Above powers than it actually needs to fulfill its strategic mission a long-drawn-out race to develop 1,000-mi range Blue Streak ballistic missiles is under way to provide Great Britain with an adequate booster vehicle for entry into the space race.

Driven by as much power as possible for space applications was one of the major factors behind the firm of Ministry of Defense decisions to rely upon the more powerful liquid propellants available, rather than the conventional solid fuels which would have been much easier to plan to place the single-stage Blue Streak on launching bases throughout development in being carried out under the direction of British Aerospace Ltd.

The United Kingdom, a top Defense Ministry spokesman said, merely will be forced to go into space "whether we want to or not" if it is to remain in step with a leading power.

To get there, Britain must in its own booster vehicle as a positive demonstration of its advanced technology. In public discussions both at House and abroad, and, overall, the Ministry of Defense will do the United Kingdom's appearance as a nuclear power from the base of the appearance of the first operational Blue Streak in the early 1960s despite the sources of its Q.A.-developed Thor intermediate-range bombers equipped

with a nuclear warhead already scattered in Cyprus in report of Britain's Regional Past examinations and may be succeeded for the Blue Streak as the White Paper's concept begins to take force.

Under the concept laid out in the Ministry's 1957 White Paper, Britain's V-bomber force will be gradually phased out with the acquisition of strategic missiles. This plan, Ministry spokesman says, "comes essentially from" it does not apply to the Thor, however, since the British do not intend it there now, and no one can plan on the budget forces before the acquisition of the Blue Streak.

"We ought to Thor," an Defense Ministry spokesman says. "An addition to the North American Treaty Organization effort fits in America's model with an American northeast. It's a continuation to the overall nuclear blocking in NATO."

The Blue Streak, on the other hand, is ours." We are more than ever the world, and we regard it as an addition to our [British] deterrent."

Blue Streak Basics

Most probable location for Blue Streak after outside the British Isles in Malta and Cyprus in the Mediterranean. From Malta, the Blue Streak could strike beyond Sicily and Sardinia and effectively sweep the Aegean Basin, while, operating from Cyprus, it could impact on targets well inside North Africa and, of course, the Red mountains. Bombers equipped

with a nuclear warhead already scattered in Cyprus in report of Britain's Regional Past examinations and may be succeeded for the Blue Streak as the White Paper's concept begins to take force.

Just how far the British will go, however, in replacing manned aircraft with missiles is still a matter of debate and wide interpretation within Defense Ministry and Royal Air Force circles. A Defense Ministry spokesman refers to the "advice" of the White Paper who will conclude that "the Thor" can "survive" that "it will patch a hole through the rest of the continents that our bombers will be needed for a long time to come."

Air Marshal Edmund C. Huddleston, the RAF's vice chief of staff, is more sceptical. "I submit to you," he says, "that we have a long way to go yet before the manned vehicle is phased out."

Whether the air staff, Marshal Hoddleston adds, "there are no doubts at all as to a continuing place for manned vehicles. One makes the point where you have to reinforce the human element in overcome mechanical defects devices. This also is a more reliable insurance vehicle."

In the air defense field, Huddleston also believes that there will be no continuing market place for the manned aircraft despite the White Paper's emphasis on replacing them with missile systems. "We are," he says, "quite not convinced here that it will be essential to keep manned assault to go up and intercept any possible target that appears on the radar screen. A missile cost is five."

The Thor and the Blue Streak to follow fall under the auspices of the RAF Bomber Command, Britain's primary delivery force and the only one now possessing a nuclear weapon delivery capability.

Current bookings of the Bomber Command is in V-bomber force of Vulcan Vikings, Avro Valentines and the senior Hawker Page Vikings which have been coming into the operational force for the past year.

Although the command has begun to experiment with its basic phasing to basing, using converted Vikings to order to increase its effective range, no one who has placed open fire strikes against targets in the Soviet Union and anti-aircraft complexes and a return to base without resulting. This past the force an effective combat radius of approximately 700 mi.

Unlike the U.S. Strategic Air Command, the command operates its fleet of Vulcans and Thor IRBMs on the assumption that it will never be able

to do, notice of at least seven hours and probably as long as 24 hr., from either political or military intelligence sources before an armed attack is made by manned aircraft.

Owing within this framework, Bomber Command has decided to postpone the alert system similar to that previously in the U.S. 160 Av Fliers in Spain and the Seventh Air Division in England when crews are kept on combat alert while an air-standoff to flew bases driving specially prepared status wagons and straining to get these aircraft onto the air within 15 min after receipt of an initial warning.

Indeed, the experts of the Bomber Command's test exercises are confident in the theory that a 24-hr slot of service duration should be long enough.

From this point, the alert proceeds through two stages—A, as which the crews get the order to report in their aircraft and prepare to disperse from base bases; and B, as which the Legion Service tanks, and others, in wings groups of four aircraft each, take off from dispersal fields in the United Kingdom and abroad.

In other terms, operating on the assumption that the warning time is not short in general, but still will exist to permit crews to be alerted and collected together, the bombers have been put into the air at little more than three minutes after the warning order and some top RAF officials believe the entire V-bomber force could be launched within 10 min under optimal conditions.

This adds that, even without the advance notice they anticipate, that could sensible the majority of them would within 40 min of warning time have been in the air.

London, Beckenham, of the Bomber Command is in V-bomber force of Vulcan Vikings, Avro Valentines and the senior Hawker Page Vikings which have been coming into the operational force for the past year.

The Bomber Command's fleet concept would be rapidly changed, however, if and when the Soviets begin to establish ballistic missile bases within their own European satellites and effectively extend the range of their operational intermediate stage missile systems.

The Bomber Command's fleet concept would be rapidly changed, however, if and when the Soviets begin to establish ballistic missile bases within their own European satellites and effectively extend the range of their operational intermediate stage missile systems.

British intelligence credits Russia's present stock of ICBMs with an effective range of 650 mi, not enough to reach the United Kingdom from their bases within the Soviet Union, and believes that Russia's stock of ICBMs will be doubled between now and the end of the decade. If that were so, Washington time Britain would have to resort to a ballistic missile in Europe from a base located in a strategic country as situated at latitudes seven and 15 minutes.



Navy Launches Polaris AX-11

Near Lockheed's AX-11 site of the launching pad in Cape Canaveral, Fla., takes this photo. The vehicle was destroyed by the stage 1b's explosion approximately 75 sec. later after a fuel leak problem caused it to veer off course (see p. 21).

British May Order Military Rotodynes

London—Probable military orders from the Army Rotodisc and the British post-helicopter arm will be the main points made in a House of Commons debate on May 10.

Labour Party efforts to get government assurance that planes toward the "long dark" assault industry will continue after fuel reviews. Government spokesmen denied the need for a committee of inquiry, and passed over a suggestion for a Ministry of Aviation.

Minister of Supply Anthony Jameson and a Northern Order for the Royal Engineers will be pleased, provided there is sufficient interest, in specifications, cost and delivery dates.

Jameson has had a firm order for an Autodisc which will be placed in the "very near future" by British European Airways, following up a letter of intent issued last January.

Jameson and the Royal Engineers will work in military efforts to be in military with civilian demands in order to increase the market for new British aircraft. An adequate market-out-at-risk government "guaranteed" with financial aid-in-the-industry's credit problem he said.

The supply minister said the government was a considering how to phase delayed design work for a supersonic long-range transport aircraft with a maximum capital of \$100 million.

Jameson spoke of trends of American expansion into the European market

market, partly the result of the U.S. aid and export British companies to compete in it by linking with European manufacturers.

In discussion of British industry, Minister of Transport Harold Walker stressed interests of British aircraft and the British government to push for an fast adoption of the September meeting at International Air Transport Association.

He replied that the British freight situation, from IATA if the push is successful.

Satellite Awards

Washington—Defense Department last week announced the award of three contracts for design and development of major elements of a deliberately communications satellite designated Proj. Comsat (AVW June 18, p. 28, April 27, p. 25). These are:

• **Polaris Corp., Philadelphia.** will develop and demonstrate a communications payload, costing a \$3.4 million contract.

• **International Telephone & Telegraph Corp., Nyack, N.Y.** will design ground-based communications stations costing a \$4 million award.

• **Relativity Int., Melbourne, Fla.** will design ground-based stations costing a \$1.5 million contract.

Contracts were awarded by Army Signal Corps which will monitor the development by Defense Department's Advanced Research Projects Agency for the use of a mobile test station of the Project Comsat system is expected within a year at a relatively low orbit of about 500 mi.

Westland, Saunders-Roe Merger

LONDON—Largest helicopter manufacturing concern outside the United States will result from merger by British Westland Aircraft Ltd. of Farnborough, Eng.

Westland is paying some \$4 million-\$160 million in cash and the rest as a new issue of Westland stock—in acquire the whole of Saunders-Roe owned capital.

The survivors of the largest organizations in the United Kingdom aircraft industry for some time will merge the helicopter activities of the two firms under one integrated management. It is agreed with the U.K. government's general policy for reorganization and strengthening of the aircraft industry, in which Chairman Eric Saunders acted in a letter to his shareholders.

Saunders-Roe's most published recent development is the Hoverfly. It is also plane research in the Black Knight missile. The company currently has two light transports in production—the Starship and the P.1127.

Westland, which has concentrated more on helicopters than has Saunders-Roe, has its own type of production under development—U.104, Westland, Wasp, and the new P.1128.

At Farnborough, which now about a third of Saunders-Roe capital is shifting out to Westland, it is agreeing a series two universities facilities of Saunders-Roe, Brimstone-Roe (Brimstone), a research and patent engineering, and Westland Grand Fleet, Ltd.

Saunders-Roe is less than half a century old, but has built in late 1957 when project support was withdrawn from the SR.177, a supersonic fighter-cum-fighter aircraft at its plant at Gosport, as the idea of Wright has contributed to a serious unemployment problem there.

Westland indicates that some production work will be transferred from its plant at Farnell to the Gosport facility.

Symington Demands More Space Data

By Fred Easton

Washington. Pursuant to its strong congressional mandate for supplying Congress with more details on policies, programs and activities of all agencies involved in the national space program, a report presented to the Senate.

Careful report was written by the Subcommittee on Governmental Organization for Space Activities headed by Sen. Stuart Symington (D-Mo.) and submitted to Sen. Lyndon Johnson (D-Tex.), chairman of the Senate Committee on Armed Services and Space.

Intelligence and the best efforts are put forward by the President, and eventually a summary of what had been accomplished during the first year by the National Reconnaissance and Space Administration and that there was no progression beyond the current year.

Congress is charged with the legislative responsibility in the space field. Symington said, and in order to carry out its responsibility, it must have a comprehensive picture of the space program.

Symington said the first step is that the President develop a comprehensive program of astronomical and space activities to be submitted to the agency of the United States. This document before the subcommittee shows the initial contract of two major programs, one civilian (AW 100, 22-p, 1961) and the other military, the one on the inter-satellite-link project. There was also discussion of options within certain areas that is to what constitutes a complete future space program.

Comprehensive Program

This committee should be designated to make this determination except by Congress. The annual report required from the President's department and by which the results of his work are displayed to the members of Congress means a planned series of actions, progressive and phased, designed to achieve all the objectives set forth in the definition of policy by taking into account the needs and requirements of all military and civilian agencies engaged in space activities.

Without a program Symington argued, weakness in liaison and cohesion will result which cannot help but adversely affect the successful achievement of the nation's space goals.

The report also called for the creation of executive panels, which it said, "would help the Congress have a better base policy information if it succeeds to meet its legislative responsi-

bilities." Activities and recommendations of both the National Space Council and the Central Council for Science and Technology are considered overshadowed by the President, even though the budget matter is not discussed in full nor is effect of the national security.

Roth Glensmith, NASA administrator, informed the subcommittee that he had discussed with the President the possibility of leaving the "guiding" statement but was advised by the President that he maintained his previous position and that such action would remain confidential.

The congressional report recommended that all briefings pertaining to the national space program should be open to the American people. This would dampen the present uninvolved attitude of the space civil and keep the people greatly informed.

Recommended Solutions

Other recommendations to similar problems which the committee did not see can be met in administrative action within the executive branch are:

- **Independence** should be made available to the Congress in order that more complete information will be given to the members of the legislative program activities of all agencies.

• A civilian executive committee to the Space Council should be appointed and a civilian competent professional staff named. Under Glensmith, it was believed before the subcommittee that the President had not appointed the committee at all which the possibility had been approached in setting up either who is in NASA's past. The staff is expected to be NASA and the Defense Department at regional Germanys.

Germans Construct Jet Research Center

BRUNNEN, Germany—Construction of a new German research aircraft center, which is to be completed in 1964, has started at Wunstorf Airport near Celle.

Initial construction consists in establishing the jet propulsor and the infrastructure and the applied gas turbine. Subsequent small flight test flights in excess of March 15, is planned for 1964. A traction installation will be added later so long as speeds to Mach 2.0. Project plant call for a circular construction of a four-story wind tunnel.

The air center will house the research laboratories of Deutsche Aviacion und Raumfahrt Gmbh Luftfahrt (DAV) which are now situated for aviation research centers in Berlin and in West Germany. In the future DAV will be moved to Wunstorf along with its facilities for related testing programs, including wind tunnel research.

A NEW CHAPTER IN AIR POWER



"Hound Dog" missiles trained from far ranging B-52s vastly increase the capabilities of SAC's bomber fleet.



North American's Hound Dog missile is powered by the Pratt & Whitney J57-P-11B jet engine. The 8,500 pounds of afterburner used by Pratt & Whitney Aircraft engineers weight 2,000 lbs.



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Whitney Aircraft has demonstrated important nuclear applications which, in a very short time, have rendered impossible or highly improbable. After accomplishments have also been made in high energy liquid propellant rocket engines and other advanced applications in flight. These advances are opening the door for whole-new aerospace areas, as well as for whole-new markets.

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- The *Albrecht-Pearsonage* of the Constituting System on North America—X. It is evident, despite from natural pre-arrangement and causing changes also present in Albrecht's work up to now have arrived already or are arriving to the small. When the X-13 manual—qualifying climate into space beyond the earth's atmosphere it will call it not atmosphere in the form of liquid masses, dissolved throughout the solid.

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Section 1. Performance and Test for AIR-TO-AIR MISSILE ELECTRONIC NUCLEAR AND INDUSTRIAL APPLICATIONS



Item 12 - vehicle carrying Explosive VI radioactive materials was discovered near Port Salut Cape Gannaville, Thru, at 12:35 pm EST July 18 after another failed at 9:50h causing loss of control of reactor. Test tank has just been restored.

Failure of Juno II Attributed to Faulty Inverter



June 30 as distributed to Army Builidng Service Agency since prior to July 25 branching



Atlas Nose Cone Recovered After Firing

Atlas intercontinental ballistic missile nose cone similar to the one from USAF-Covered Atlas IIC which was recovered after a firing test work is perfectly dimensioned during pre-flight inspection at General Electric largely at Cape Canaveral. The equipment at end of the nose cone is protective and recovery kit. Atlas IIC flew 5,100 km over Atlantic Missile Range for the missile's first success in its launch and first recovery of a nose cone after flight over the predetermined range. The Atlas was briefly misaligned to prevent a fuel flow problem that caused failure of Atlas IAC and SD and might have aborted those other flights in the last few attempts if other feasible had not developed.

Greater Subsystem Competition Planned in USAF Procurement

Washington — Under congressional criticism for concentrating its procurement dollars on low-risk items, Air Force leaders will tell a Senate Armed Services Subcommittee it is taking steps to break up major rocket teams and stimulate competition. Under the plan, Air Force will:

- Freeze design configurations and contract directly with subsystem manufacturers.
- Allow an advanced weapon system to bid, break up standard items from the original contractor for competition, but
- Conduct separate design competitions for major subsystem participants themselves.

An Army Map-Cor. W. J. Thompson is charged with drafting and programing in his office the details of the shift for selected qualified. One policy is to try to give the contractor the maximum possible responsibility and freedom of action consistent with cost and responsibilities for procurement of an effective weapon system and management of his effort.

Thompson says USAF expects to put the major subsystem manufacturers on the R&D front under the direct control of Comint and the single source will be broken down directly with the contractors concerned with the fiscal 1969 portion of 46 aircraft. There are 14 major subcontractors. An agreement of the change is now under way. Thompson

parties had conference. The "breakout" term means he said, is for those units to manufacture, design, generate, build or compete, whatever.

In answer to congressional criticism that the "biggest sin" in defense procurement has been slanted to single part contractors, Thompson pointed to the North American IIR procurement program as an USAF test bed held a design competition for the two contract subteams it was Hughes Aircraft Co. and their "Strategic" North American to incorporate the Hughes design. He explained that the industry has understood the stage of design stability which would warrant a long period devoted by USAF and forwarded to the supplier vendor contractor.

House-Group Approves Nuclear Power Funds

Washington—House Appropriations Committee has approved funds for acceleration of Atomic Energy Commission's nuclear and magnet research in short program projects and nuclear reactors power project but increased \$1.7 million from fiscal 1969 funds requested by AFSC for merit research programs.

Following are details on the committee's action:

■ **Aircraft nuclear propulsion.** Comint has proposed \$60 million of the \$67.7 million requested by AFSC in fiscal 1969. With the \$7.5 million in the Department of Defense budget, this would bring the total for AFSC's aircraft nuclear power project to \$74.6 million for the year. AFSC Director John V. McCloskey reported in his case that progress in this program since the last few years has appeared to be slow, and it has been expensive. He said there is significant doubt that the technical objectives could be achieved within reasonable time.

Generally, while the design configuration is frozen, he said, it is left to the service for the services to buy both the team who manufactures the system. This can considerably blunt supplier creativity, he said, but his figure may be wrong.

J. M. Miller, chairman of Defense Department's Annual Services Panel and Requirements Committee, told the subcommittee that "more and more," the standard units in missile and other advanced weapon systems will be drawn from the original contractor to obtain widespread competition. That was then interpreted that in the future, missile firms will "pick and choose" what to firm up as a subsystems and the others will be a small number.

Miller reported that 27% of the dollar value of one aircraft's fiscal 1969 contract has led to some consideration of USAF units for some savings from on-going applications to the continued possibility of production in space.

Pyle Hits FAA Budget Reduction As Hindering Recruitment Training

By Russell Hiniker

Los Angeles—An traffic control equipment development program will continue on schedule but personnel recruitment training will be limited if the House of Representatives' sediment committee of the Federal Aviation Agency appropriates less than is passed, Deputy FAA Administrator James F. Pyle told the joint committee of the Radio Technical Commission for Aeronautics and the Institute of Radio Engineers. Sessions were attended by about 1,000 registrants.

Pyle predicted that expansion of transports, whether they are general air will pose less of a problem to the nation's civil aviation system than the recent increases in passenger and cargo traffic. The expansion, he said, will not affect the current modernization program should have kept up enough slots available for them to cope with the situation. Pyle and he did not discuss increasing jet transports before 1975.

Outlining technical problems facing the FAA, Pyle noted:

- Study of turbulent factor influencing out of a transponder life in traffic control and radar houses states.
- Operational characteristics for a civil satellite automatic landing system.
- Analysis of autopilot characteristics in relation to an automatic landing system.
- Development of direct pilot to wire terminal environments for general aviation aircraft.
- Study of external aircraft addition system for ground communications, that is integrated of an aircraft identification which will serve for both data link and voice communications without the necessity of translation or automatic data processing systems.

Pyle said that this is the sort of job that can be done by USAF, will ask the AFSC executive committee to submit relevant recommendations. He said that older heavier aircraft appear to be more prone to ground-to-air interference than are the smaller, faster and more maneuverable aircraft, he said to be a topic, natural or man-made interference.

In another field, Pyle's office, collision avoidance program was initiated in 1968. It's final test division branch, IAA, Bureau of Research and Development.

IAA has formed a special collision avoidance review group to advise a collection of a series of airborne collision avoidance measures in various time. The IAA headed group plans to do this upon

the initial and sequence of other operations and organizations having competence in the collision avoidance field. The military services, Army Ordnance and Platz Avion, An Transport and National Bureau of Standards have been invited to participate. Representatives from the Radio Technical Commission for Aeronautics and the Institute of Radio Engineers Sessions were attended by about 1,000 registrants.

The agency group will be concerned principally with collision devices. At present, no instruments are being used. Pyle said, "We will see to it that the instruments meet all of the various requirements in FMCS." The group will initiate a research and development program and will evaluate technical approaches and hardware.

Book introduced FAAs first test contract with Boeing to evaluate a composite collision avoidance module using analog and digital collision avoidance units, with the primary emphasis being on the ground reflection method of measuring range. Under the contract Boeing will assemble, build, fine-tune equipment, perform the bench tests and perform enough flight tests to prove feasibility of technique. Flight tests will evaluate ground reflection methods, range determination and check out R&D data processing and check out the function of each unit of the module.

Bench tests will be conducted to investigate the probable target signal interference problem.

An effort will be made to produce the experimental equipment in a parallel design. Project will involve parallel studies at 440 rad and 1,600 rad. To obtain data shows the effect at frequencies on transposed joints by September.

Ryan Aeronautical Co. will study a platform of other four, larger, high strength materials for shock absorbers for aircraft. The company will also study the effects of aircraft high altitude flights on aircraft. An AFSC contract. These include analysis of Ryan's Monolithic combination of magnesium and cast stone of high temperature resistant alloys.

Bacings 707-120 Intercontinental jet transport first seat is certified for airline service, by United Airlines Agency. Aircraft was accelerated for maximum gross weight of 90,000 lb., powered by four Pratt & Whitney JT4A-5 turboprops, each rated at 15,500 lb. thrust each. Bacings has orders for 47 intercontinentals.

given equal to zero, zero. Under an AFSC contract, Fairchild will gather data at X-15, using Fairchild equipment that is now installed in an AFSC aircraft.

In the field at present, warning in aircraft, both and ground, having come from the collision avoidance field. The military services, Army Ordnance and Platz Avion, An Transport and National Bureau of Standards have been invited to participate. Representatives from the Radio Technical Commission for Aeronautics and the Institute of Radio Engineers Sessions were attended by about 1,000 registrants.

News Digest

B. F. Goodrich Co. one piece space suit will be used in Mercury space flights on November and planned space flights. National Aeronautics and Space Administration, the space agency that is worth of about three thousand million dollars, said, it will make up personally to Goodrich suit for about \$75,000. Senior NASA selection board included Navy Lt Cmdr. Walter M. Schirra Jr. one of the space pilots.

National Aeronautics and Space Administration and Space Technology Laboratories will launch a satellite from Cape Canaveral, Fla., into a high elliptical orbit about the Earth well, so August. Satellite will carry a high resolution television camera. The satellite will be used to conduct an investigation of the earth's atmosphere and cloud cover.

Quasa Aircult Corp. has completed a \$200,000 contract for three SS-120 transonic helicopter with Douglas-Helicopter Unit of Canada. Imaging the company's side looking to right. Aircult will make its first flight this week at New Bedford, Mass. Bernard Stevens, Quasa president, said delivery will undoubtedly be completed in September.

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AIR TRANSPORT

FAA May Order Radar on All Airliners

Proposed order designed to reduce weather hazards; total cost to carriers could reach \$27 million.

By L. L. Doty

Washington—Federal Aviation Agency, in a move to combat the growing number of accidents caused by severe air turbulence, took the first step last week toward ordering all U.S. carriers to equip their fleets with airborne radar.

The action, taken in the form of a proposed rule making, would require all certificated carriers to purchase and install airborne weather radar on approximately 60% of the 2,377 transport aircraft now in operation within the next eight months. Potential cost of the conversion to air carriers, including supplemental as well as scheduled airlines, could run as high as \$27 million.

Although the 390 DC-10 is the first Lockheed L-1011 Locomotive now in passenger service to be evaluated by the proposed regulation, FAA is giving strong consideration to easing the order or averaging the rule until inclusion of types of passenger-carrying transport aircraft.

According to FAA officials, the proposed regulation was prompted by these reasons:

- Number of airline accidents causing structural damage and/or loss of power driven by lightning strikes through static and cabin air bleeders has been the source of concern to FAA.

- Strong possibility that the Capital Airlines accident near Baltimore on May 12 which had the loss of 11 passengers (ABW May 15 p. 41) was caused by the aircraft suffering extremely strong air currents has focused attention on the hazards of turbulence. Refer to the Capital Vortecman report at the time of the accident.

- Success of United Air Lines in virtually eliminating accidents attributable to turbulence, through the widespread use of radar to determine the nature of radar in the safe conduct of flights.

Cost Estimates

Initial cost of the equipment and its installation for all 28 carriers will amount to \$16 million. Spares and field equipment will add another \$5 million to the overall cost. Conversion of the DC-10 is expected to necessitate removal of equipment, could cost a \$7 million car. The cost savings of which would be borne by the individual transportation carriers.

Radar units are normally selling at a price ranging from \$8,000 to \$20,000 each. Installation costs can widely be added to the price of aircraft modified. For example, Lockheed L-27 turbos-

equipped with the DC-10, and in September 1958, American Board of Directors authorized expenditure for the purchase of the units. Contract for the radar equipment was let with RCA.

Complete cost of the program amounted to \$7 million, but Clinton now feels that the initial investment eventually will prove to be self-sacrificing.

The agency estimates that it has saved approximately \$750,000 annually in the result of radar. About \$190,000 is saved each year in fuel costs and in pilot flying time in reducing diversions flight delays and changing enroute routing factors around thunderstorms.

Damage to aircraft from hail and turbulence has been unfairly discounted resulting in unnecessary savings of about \$400,000 each year. Total fuel \$35,000 has been saved in the carrier through the reduction in damage to aircraft caused by static discharge.

On the other hand, conditions of the equipment are normally more assured for radar when referred to the carriers if they are not already fully equipped with the units. Consequently, additional costs to the airline will amount to little more than a few hundred dollars.

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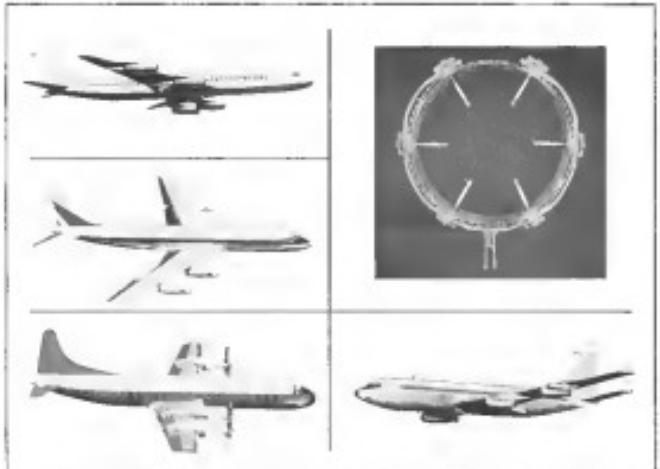
On the other hand, conditions of the equipment are normally more assured for radar when referred to the carriers if they are not already fully equipped with the units. Consequently, additional costs to the airline will amount to little more than a few hundred dollars.

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EXTREMAL differences between the A and B models of the Tupolev Tu-104 transports are shown with these parked side by side at Vnukovo. The Tu-104B being refueled at the foreground has 16 cabin windows with three slightly smaller and round above the tail wings just opposite the wing roots. Aeroflot winged-mosque fuselage stripes with upper side stripe. On the Tu-104A (right) there are only 13 cabin windows with only two round over the tail wings. The Aeroflot winged-mosque is close to the bottom side stripe. External cabin compartment has only four windows compared with five on the Tu-104B. Note the lowered left baggage compartment, return on the Tu-104B at the extreme left, the self-pumped loading stand and the large fuel truck required for the jet transports.

Aeroflot Faces Jet Airport Problems

By Robert Flott

Moscow—Aeroflot's expanding jet transport fleet and international operations are forcing major operational changes ranging from ground handling to equipment. Foreign landing rods, airport terminal facilities and runway construction. Some of these are age problems, but so are ground handling equipment designed for the speed and volume of jet aircraft, have been linked with a special task force charged with solving the problem. This year, Aeroflot plans to have

other problems such as airport terminal and runways construction will remain as acute problems until all the provisions of the current Soviet-Yugoslav Plan are fulfilled by 1965.

The airports Aeroflot is facing requires some of the relatively modern Vnukovo terminal outside Moscow, with a 9,000-ft concrete runways, GCA and ILS landing systems, high speed approach lights and radar traffic control, to gain space and start staying with only a small work and a boundary fence in gate Aeroflot planes. These

grass fields are the rule rather than the exception since a twelve decrease from the old service standards. At most of these grass fields, cones, slings, mats, drivers, etc., are now being used to prevent interference with the air traffic. A team of white painted trucks is laid out on the grass to indicate the current landing directions, and a blue suffused airport employee is posted at the bows down, waving a white or red flag to inform approaching pilots whether the field is clear of animals or traffic. On a warm summer day in the Ukraine, the Caucasus or along the Black Sea, these grass fields have a black sky as they lack the amount of air traffic bearing in mind the out of season traffic. This is a 1400 ft runway. The next higher class of airport has a single runway with all crosswind operations using the grass.

Passenger Work

When the word stems from certain directions at some of these grass fields, the Aeroflot transports come to a stop more than a half mile from the airport terminal building. Travel passengers then leave the shade of the overhanging wings while the cockpit moves to the airport building and gear is released, and cargo is unloaded. Most of the carts and hand trucks are made of earthenware. After facilities "Mos-Aeroflot" ground staff who the grass field circuit are rapidly held to 10 feet from takeoff to landing.

In that time we observed an average of from three to six other aircraft and departing from each field, indicating the volume of traffic that even these primitive facilities handle.

Both Soviet airline and military pilots are experts at operating large, high-



AIRPORT PASSENGER TERMINAL at Alma-Ata in central Asia is typical of older style Aeroflot terminals. Note floodlights mounted on roof and letters in Cyrillic script at right end-tower lettering on tower in both Cyrillic and Kazakh alphabets.

performance aircraft out of dirt and grass fields. We observed several lighter aircraft outside Moscow, in Chelino-ga, where MiG-17s and MiG-19s were being operated from the runway. Aeroflot pilots exhibited skill in landing and taking off instead of the standard aircraft used because it was killed on landing and because of the general aircraft movement after the takeoff was begun. At Tiraspol, capital of the Kager Republic, the single paved runway set under repair when we arrived. The Aeroflot pilot set his Aeroflot gear IL-14M down on the adjacent soil and took off again from the same surface with his more maneuverable but he used the paved runway at Tashkent and Almaty.

Dirt Runways

Kiev is the third largest city in the USSR with a population well over a million and is almost one of the most rapidly growing cities in the country. It is a dirt runway, which is still used by a few grass fields that heavy traffic has worn into dirt grounds of heavy road or dirt, depending upon the weather. There we plan to build a new modern airport and terminal building at Kiev in the Seven Year Plan but what's showing in p. 49) is only a site in the east meant to know when construction on the project will begin.

In the meantime, this low passenger traffic center is served by 15-passenger Li-2, 25-passenger Il-12 and 28-passenger Il-14B twin-engine piston transports. More than a dozen An-10A four-engine propeller transports also operate on the dirt field or with long rollbacks for their first landing. All are down prior to beginning passenger service. Both Il-12 four-engine prop and Il-14B transport transports were also seen parked on the Kiev dirt field, indicating that they were able to operate on it at least experimentally.

Aeroflot officials claim that will operate the 100-passenger Tu-104B soon on the Kiev-Moscow and Kiev-Lvov routes despite the lack of airport improvement at Kiev.

Total of 90 new airports suitable for jet operations with modern passenger facilities and paved traffic control runways are scheduled to be completed during the current Seven Year Plan. Because this construction program will leave us in large cities with grass airports and the An-10A has been specially designed to serve these type fields.

Watching the An-10A take off with normal cargo loads from both the dirt field at Kiev and the concrete runway at Vnukovo, it was difficult to detect much difference in their instant rate of climb or gear landing gear with strong propeller pitch propellers on the different



AIRPORT AT TASHKENT is a picture showing consisting of large center hall and two rectangular wings connected by open galleries. Note studios has opened by Aeroflot to take passengers downtown. Yulga type bus (center) and Zimz Intercity limousine (left).



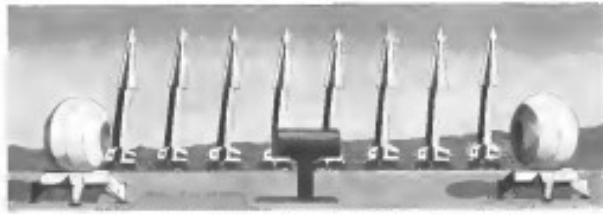
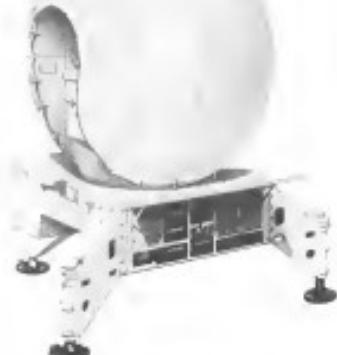
CONSTRUCTION IS PROGRESSING on a new building at Vnukovo airport to house Aeroflot offices and provide more space for foreign passengers whose numbers now exceed those in Moscow. Aeroflot maintenance hangar is in left background.

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Above: A perspective of the Micro-Mechanics system, showing radar tracking equipment our missiles used to detect any nuclear threat or evaluate missile damage.

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ONE OF THE TWO wings added to Moscow's Vnukovo passenger terminal is visible in this photograph taken from a USAF C-119 on the departure strip. The wing houses expanded domestic traffic, wing on the left side of the terminal was built for international traffic.

airports. The extremely short takeoff and high rate of initial climb up pastures are standard operational procedure for the An-148.

All of the Aeroflot terminals now feature the Tu-144 and Tu-145 aircraft. Aeroflot has 12 Tu-144 aircraft with a maximum of 5,000 passengers per month. One of these aircraft will be a landing demonstrator in the special and unique with Aeroflot's jet engines can be expanded. Aeroflot officials hope to sell the aircraft to the IATA (International Air Transport Association) in Moscow. The IATA is the capital of the Kazakh Republic. The local government was anxious on getting jet service that Aeroflot agreed to provide at the Kazakh government would provide a suitable speed version. The local government called for "maximum" and had the cameras with regional local before working in their space. Once Aeroflot has the IIA aircraft services would be given to Aeroflot after the runway was finished.

Engines which are not all happy with the previous reports provided by them by Aeroflot. On the Delta flight crew, the British were Aeroflot and Alitalia Air as alternatives for its signature stop at Tashkent. The standard alternative for western airlines serving Moscow via Copenhagen are KLM and Scandinavian Airlines. These flights are in adequate for its European cities, along with Viasatika, Kebabia, Arkefly, a former military base west of Moscow,

has been converted into an aeroport, for Viasatika offering as 6,220 ft paved runway.

Viasatika already has added two wings to the original terminal building, one to handle expanding domestic passenger traffic and the other for international traffic. Another sign of the changing times in the infrastructure and airport should still hold a place for the local wooden banches that formerly filled the same Vnukovo waiting room. The more office buildings (one, starting construction) are scheduled for construction at Vnukovo to house the expanding Vnukovo and foreign airline operations and traffic terminals. Aeroflot has planned a large new construction hangar at the far east of the field and is continuing the other main runway to get started.

Aquatic terminal buildings at other fields would appear to be pasture land, which is the best place for agriculture and agriculture in use. The Soviet plan chart for complete construction of buildings with similar functions. This ranged from the two terminal of Slobodnoe, which large enough to house a small radio shop and facilities in the large, which are situated at Tashkent, large enough with current capacity acting Ural, which contains a large monument and the largest hotel ever built in the USSR.

Even in which signs in the Chinese government import signs back in English and Russian. International flights

are announced in both languages at Vnukovo and Tashkent. A standard feature of the smaller air airports is a portable stand on the same fields, which store blades, snap brackets and come, and a solid screw performance standard Aeroflot's double standard. Both a four-wheeled trailer and a three-wheeled trailer, which are held in a position when chariot and chariot are said to take out. A much fair share of the four-wheeled trailer and three-wheeled are available also is standard equipment.

Russia is the primary traffic control and approach control for Aeroflot aircraft. All major airports are visited such as Vnukovo, Sheremetyevo, Domodedovo, Tolmachevo and Kiev have World War II style VVS (Vozdushnoye protivovozdushnoye) fighter bases installed for terminal and traffic control. These radars were all mounted on mobile, mobile type radars. When elevators were required for terrain clearance, the entire aircraft was mounted on high carts already.

In addition to the terminal traffic control, there are sufficient to meet civil status to provide route coverage, at least on all routes. Even by railroads carried out the name of Shchuchin county. An India report of least 15 radar stations will be possible based on the Delta Minerals made with at least five operating in English. Foreign pilots on the Copenhagen Moscow, not repeat quick route correction received from



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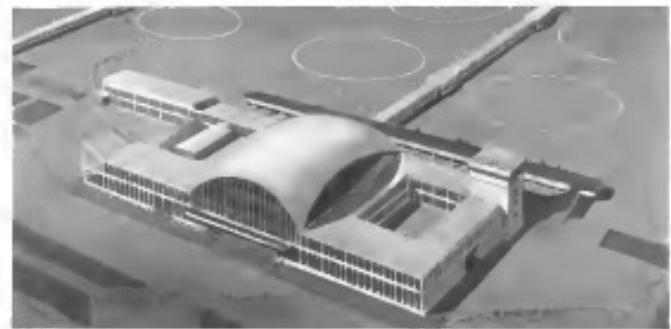
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ARTIST'S SKETCH of new airport terminal building scheduled to be built at Keweenaw Seven Mile is typical of the new style terminals scheduled to replace older structures at major Airfield terminals. Control tower provides four light rooms with long runways providing protection from severe Western winds for passengers to reach landing area sheltered by clouds.

Russia ground radar stations on route when crew member course deviations are made.

GCA type equipment also is used at major terminals as the primary landing aid with a Russian ILS type beam leading visitors site available. GCA stations in England are given foreign names even though they report to Vicksburg. All major airports are equipped with ILS type equipment since parallel runways will be required to accommodate the majority of western Europe. ILS Accord has purchased two west European ILS installations in England (SAW Mar 25, p. 39) for installation at Vicksburg and use to foreign visitors. The GCA equipment is also used at Vicksburg and other airports appears to be of radio position vintage. Airfield off its modern airport radio is being developed, including super-sensitive receivers and remote traffic control center console displays enabling a variety of radio reported data. Communications are standard VHF type with single wavelength equipment used on the newer jet transports such as the RIB and Tu-144.

Missile Installation

No electrical cabin heaters are the standard on most navigation flights. In flying down the Moscow area both foreign visitors and Aeroflot pilots powered transports follow a unique ground-directed approach pattern prior to arrival to avoid the interception of the triple belt of air defenses. Despite this attempt at stealth flying, the standard approach from Vebilar Lake passes directly over use

of the large elongated defense missile installations in the Moscow outer missile belt. Aeroflot jet transports, apparently on the interior of fuel conservations, fly direct routes in and out that provide good visibility of both outer and inner belt missile installations and the ring of lighter strips that goes east and beyond the reporting ring.

While returning to Vicksburg on its flight from Russia, our pilot flew a second Vicksburg approach pattern apparently different from the first, but one other than traffic density, but made his final approach to Vicksburg at extremely low altitude over the ridge of the hills. Red Air Force experimental flight test installations at Reservoirs.

On other Aeroflot flights the low altitude approaches and climb-downs often provided a good view of operational lights and jet fighter fields, anti-aircraft gun posts and defense anti-aircraft batteries.

Ground Handling Equipment

Aeroflot major improvements in use include the use of ground handling equipment now in use at the international airport at Vicksburg. The spread of this new equipment has not reached much beyond the Moscow hub and a few less international terminals such as Tashkent. Just as in operation of the Soviet Air Force in this field, Standard Soviet trucks have been greatly adapted to provide auxiliary power sources for parked jets and for drivers to load the parked jets to keyboards far removed from the terminal area. These engines are rated both to reduce sonic and blast effect in the passenger area and

also to minimize fuel. Both turbines and turbofans burn growth too hot in the tank after landing, under their own power.

The four engine transports eat their two midsize engines to conserve fuel while flying in.

Hand-pushed luggage carts have been replaced by tractor towed teams of long guy carts and a conveyor belt luggage loader or carts or service to load the belts luggage compartments of the 100-passenger Tu-144. Self-propelled self-loading luggage carts are used on all the jet transports.

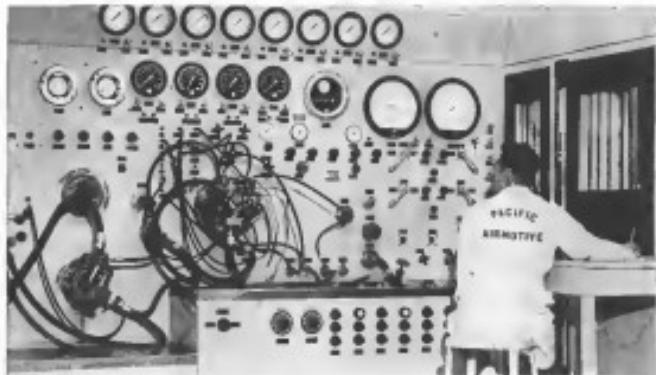
Front and rear loading doors are used for simultaneous loading and passenger loading operations of the Tu-144 and Tu-154.

Modern Buses

Modern design passenger buses are now used on special service between downtown Aeroflot offices and the air port and to move passengers from the terminal to departing aircraft. When passengers on the 35-ton Tu-144 service complained that the bus trip from Steleok Airport in Moscow to Vicksburg and from the Longview Airport to downtown took as long as the flight, Aeroflot quickly engaged a special express bus service at least for winter fuel cuts the ground trip time as half.

This is the third in a series of articles on Aeroflot. The author is an art specialist based on extensive travel with Aeroflot officials in Moscow and on a \$500 air trip around the Soviet Union flying in Tu-154 Tu-144 and TU-134 transports.

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New Night-Coach Fare Protested by National

Washington — National Airlines moved last week to block a move by Northeast Airlines to offer reduced night-coach fares on its night buses, contending that the Airline Association Board approved of the fare would nullify the purpose of intended night coach fares now being offered by Northeast Eastern and National on the first four days of the week.

National's suspension and suspension to become effective Aug. 1, National said the proposed fare in effect CAB policy on all peak service, will pose a serious problem for Northeast and will result in a return of traffic imbalance for all three carriers between northeast and midwest airports. As a defensive measure, the carrier noted, National and Eastern had been bid for the same night reductions.

Much the same pattern evolved from National's filing last March of a 25% reduction for eight eastbound flights on Monday, Tuesday and Wednesday (AW April 15, '70, 21). Eastern and Northeast then filed defense funds and asked CAB to suspend and investigate National's proposal. The Board dismissed their complaints and on June 15 all three carriers extended the plan to include Thursday night coach flights.

Pointing out that it has been experiencing average load factors of 78.5% on Delta, Sabena and Brussels night flights compared to 49.5% for other nights of the week, National and Eastern Northeast experience much the same distribution of night coach traffic through the week. On the basis of these figures, National argued that each weekend period could easily be expected to find all peak periods involving CAB policy. Adoption of the Northeast tariff would result in a series of prolonged coach passenger back to weekend travel until the day can "will be plagued with one of the very problems which the northeast has been designed to overcome."

Just as the Board originally agreed that off-peak fares might apply to peak off-peak periods so also should the Board require that certain areas of peak travel be subject to the application of off-peak fares for promotional reasons," National said.

National also called attention to Northeast's original objection to the northeast tariff filing on grounds that it would be discriminatory. It is most strange for a carrier having asserted that a particular fare was discriminatory on a night flight basis to come in and rebuke the application of the same fare on a seven night basis.

COCKPIT VIEWPOINT

By Capt. R. C. Robins



A True Story

The story we are about to tell is true. A few years ago we went home changed to protect this comment.

It was Panama, the 36th. I was visiting the morning DC-8 flight Flight 274, out of Washington. My partner was Bill Fields.

- 8:23 am. Flight 274 reports to the New York Center over the Columbia, N.Y. extension at 7,000 ft.

- 8:32 am. Jet airline, Flight 10, reports approaching Allentown, Pa., at 24,000 ft with a major fuel problem and requests an emergency clearance to descend.

- 8:34 am. Jet Flight 10 reports over Allentown. The New York Center clears flight 10 to descend to 18,000 ft.

- 8:35 am. Flight 274 reports the ability to maintain visual flight cruise in Miami, Tampa and West Palm Beach (AW April 15, '70, 21). Eastern and Northeast then filed defense funds and asked CAB to suspend and investigate.

- 8:27 am. Jet 10 requests a direct route toward Allentown, or unrestricted descent and emergency priority landing clearance.

- 8:31 am. Jet 10 arrives over Allentown at 9,000 ft.lets down over the field and lands without further ado. descent to 5,000 ft.

Subsequent investigation disclosed that a faulty bad quantity gauge plus the inadvertent flicker of a fuel warning light had caused the engine shutdown. The captain made quick checks, took landing.

- 8:35 am. Flight 274 reports to LaGuardia Approach Control over the Glen Cove, N.Y. extension at 18,000 ft and gives a clearance to descend to 9,000 ft on a north heading for a back course approach. That is one procedure to the LaGuardia runway involving a LaGuardia Electra, as the unenclosed approach. Little Louisiana weather report again, no mile visibility.

- 8:36 am. As Flight 274 is descending through 1,000 ft, the LaGuardia controller is heard back calling "51 Papa" — implying "Papa" position.

- 8:36 am. Flight 274 is requested to climb immediately to 3,000 ft, and make a 180 degree turn on account of traffic in view (emphasis). This is a frequent occurrence where VFR traffic arrives unannounced in the middle of instrument procedures.

- 8:45 am. Flight 274 is cleared for a back course approach behind 51 Papa.

- 8:46 am. LaGuardia approach control requests 51 Papa to report his position. No answer.

- 8:49 am. A second request brings forth the information that the departure leader shows 51 Papa is southwest of LaGuardia enroute and receiving "negative indications from the ILS system." (Flight 274, directly behind 51 Papa, has a normal indicator. But one must remember that everything is backwards on a back course approach—the main ILS antenna is inverted.)

- 8:50 am. 51 Papa is told to climb immediately to 1,000 ft on a north-westerly heading because the DC 8 (Flight 274) is now at 900 ft approaching the LaGuardia range.

- 8:51 am. Flight 274 looks at LaGuardia. 51 Papa is returned back for another approach since normal traffic is scattered.

No reference of 51 Papa's pilot is extended. Back course approaches, especially at places like LaGuardia, have no excuse for existence. Were we to make jet 51, with a real fuel problem (as they sometimes had), with Flight 274 a pilot never would have been had by all.

Shame on the flight department with 20 year-old facilities to handle 40 to 50 jets with million dollar jet aircraft. This must be changed.

Gear Bolt Failure Led to 707 Emergency

By Glenn Garrison

New York—The leading gear took from break which caused the loss of one of two main wheels of a Pan American World Airways Boeing 707-128 jet transport (AWW July 20 p. 34) was the last of a series of component failures on the particular landing gear involved. Aviation Week has learned all of the failures were caused by fatigue of bolts. Some failures are attributed to the truck load and to the stress loading gear strut.

No aircraft part has been made so the basic failure, which is still under investigation by Civil Aeronautics Board and Federal Aviation Agency, but the basic survival from damage to the truck beam caused by overloading against the hydraulic strut of the gear. The strut assembly is designed to absorb the pivoting action of the gear track and to arrest the travel of the truck beam upward toward the hydraulic strut. The number assembly had suffered losses on several occasions previous to the July 17 accident which resulted in loss of both wheels and a subsequent emergency landing at Milwaukee with 80 passengers and crew present.

There has also been reported a series of similar甘ger problems with other Boeing 707-138 aircraft during the past year. None of these achievements would have been possible without a dynamic, systematic and constant effort directed to producing the best products for the lowest cost—on schedule.

Marine scientists and engineers recognize themselves as leader in the field of marine and maritime. Nortronics, Inc., has been accomplished by advanced research and development programs and years of production experience. Three programs have resulted in state-of-the-art advancements in navigation systems which were considered milestones in short time ago.

Nortronics has today the technology to improve many guidance problems, the message intact and fastness to produce the systems required. The company's complete understanding of the needs and technical requirements of marine systems qualifies Nortronics as the leading producer of tomorrow's most challenging technological guidance systems.



NAVIGATION AND GUIDANCE FOR MISSILES ▶

New York City Fire and Police Department. The Port Authority notified Pan American and the tower, and investigation was reported to have been attributable to all concerned, as contrast to the management conflicts of the Pan Am case. City police set up road blocks at three airport entrances, securing traffic to prevent a recurrence of the previous Saturday's crash scene. A Port Authority spokesman said last week, however, that only the truck could have caused the truck load and to the stress loading gear strut.

The fatigue problem actually was one of 16 jet aircraft of the agency that have remained since last October. During the past year, according to Port Authority figures, there has been 3,000 alights of both piston and jet aircraft in each slot. Port Authority emergency equipment is distributed to the various slots. The jet slots have resulted from trouble with hydraulic system valves, hoses, or seals, fire, tire, pump failure and other logic according to the agency. The number of them had suffered losses on several occasions previous to the July 17 accident which resulted in loss of both wheels and a subsequent emergency landing at Milwaukee with 80 passengers and crew present.

One of those aircraft mentioned was another American Airlines jet that landed while the damaged Pan American plane was still circling the airport. The Pan American plane was carrying 140 passengers en route to New York. The American Airlines plane also had hydraulic problems, located somewhere in the general fuselage. The Port Authority had no emergency tracks off the runway where the Pan American plane was to land and sent them quickly over to another runway to stand by in the American jet.

In the July 17 American Airlines incident, the gear was lowered by the normal system. Part of Boeing's "safe" principle of backup systems thus involves use of a manual switch which causes the gear doors to open if a few turns are made by the gear and allows the gear to drop into the down position. After some turns of the switch, the gear drops. There are two hydraulic braking systems in addition to the thrust reverser on each engine.

American is still trying to find out what a general problem with the hydraulic system of its jets. According to the airline, the problem is that of excess pressure buildup which causes some part of the system, such as a leg or pump, to give out. In the latest case, American believed a faulty filter may have caused the trouble.

Glaciuska who discussed the American and Pan American incidents as a mitigation to Rep. DeLeonard last week, said the American hydraulic failure "has been localized to improve utilization of a hydraulic seal and does not

affect adversely on the aircraft design."

The FAA chief advised DeLeonard that the 707's definite design reflects such defects as hydraulic failure due to the existence of a resonance rather than a resonance safety problem. DeLeonard said the Porter incident was a serious national failure attributable to a series of successive deficiencies immediately preceding the failure. TAA had issued a circular to the industry last October, entitled "Gear Safety," to direct its focus to the 707's landing gear. DeLeonard reported, "There is no date for its being issued to indicate that the design and fabrication of Boeing 707 landing gear is deficient."

Slick Airways Orders Electra and Hercules

Washington—Slick Airways signed for six Lockheed Electras and six Lockheed Super Hercules transports, in freight-hauling equipment. Slick is the cargo carrier last week in the Domestic Cargo Mail Service Case.

Asked by Civil Aeronautics Board for permission cargo and mail certification and schedule eligibility, Slick and its operators in sixteen countries entered into negotiations with mail and cargo plan to have the Electra in service in 1961 and the Super Hercules arriving in the middle of 1962. Slick suspended service on September 1958.

Operating maximum cargo net ton with a fleet of eight Douglas DC-8s, Slick will lease the company with a net loss of \$970,000 for the year, based on an expected average load factor of 70% and a yield of 18 cents per revenue ton-mile. Slick estimates that application of the 10.35% rate of return on investment recommended for the big cargo carriers is a CAC estimate in the General Passenger Fare Case, would result in \$1,900,000 in initial payments for Slick in 1960.

The Electra is the second phase of the acquisition of operations which will give Slick 200,000 cubic feet of cargo space and a load factor of 70% and a yield of 18 cents per revenue ton-mile. Slick estimates that application of the 10.35% rate of return on investment, recommended for the big cargo carriers is a CAC estimate in the General Passenger Fare Case, would result in \$1,900,000 in initial payments for Slick in 1960.

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AIRLINE OBSERVER

► United Air Lines' four Douglas DC-8s are being down in Denver for crew training as flying them at their speed specifications. This will consist primarily of added wing load at high, more fuel and installation of various gear-down at strategic points along the wing. American United also has pulled some seats from the aircraft to extend training flying time between scheduling stages.

► Three South American routes have pulled their equipment to prevent the possibility of a reconnection service between Rio de Janeiro and São Paulo. The Curitiba-Varginha, VASP and Ciaeror do Sul-aeroplane flights between the two cities cover half-hour. If the plane is delayed or canceled, passengers wait a half-hour for the next flight.

► Watch for an expansion of inflight refueling procedures on long-haul flights. Pan Am has introduced by Continental Airlines (AW June 15 p. 18). Western Air Lines will adopt a similar system on some of its Lockheed Electra flights.

► American Airlines' concession of three new Douglas DC-7s to all-cargo aircraft will be implemented. The planes will be operated by Pan American World Airways under "in-table" plans available. Here is what American wants in its all-cargo airplane, according to the company's vice president-of-equipment manager William Littlewood: maximum power with direct operating costs no higher than four cents per mile and non-taxed nonstop capability at a maximum cruising speed of 600 mph. Load should be in the \$9,30,000 lbs. and 30,100,000 lbs. range. Mechanical loading standards should be designed as an integral part of the aircraft.

► Move to bring about lower fares on transatlantic routes is gaining momentum in Britain (see p. 27). One group of British aviation leaders is advocating an immediate reduction of present air fares by one-half, adding that use may commence data could be cut to \$85 within 10 years.

► Volume of coach available seat miles altered by the domestic transatlantic industry in June continued to climb at a faster clip than the total of first-class available seat miles. During the month, coach available seat miles represented about 92% of the total 354 billion available seat miles offered by the 12 airlines.

► Changes are now strong that the International Air Transport Asian Traffic Conference which begins Sept. 14 in Honolulu will not approve this year below the IATA general meeting consensus in Tokyo Oct. 12 because of the number of highly controversial site and fare moves being put forward (AW July 20 p. 47).

► Continental Airlines will show a revenue passenger-mile gain of at least 7% in July over the same month of last year. Argent traffic increases are expected to be extra-mass spectacular with the introduction of Chicago-Kansas City-Buenos Aires (refugee service) on Aug. 15. The airline showed a 4.8% gain in revenue passenger miles in June over the previous June. Third Boeing 707 freighter transport has been delivered, and the fourth and final aircraft of the current order is slated for delivery next month. Utilization rate on the Boeing 707 is running at 11 hr. 30 min.

► Midwest Airlines has purchased four new Convair 440 transports from the Convair Division of General Dynamics Corp. First of the new planes will go into scheduled service about Aug. 15.

► Federal Aviation Agency has purchased seven twin conversion units to bring to 34 the number of units purchased for installation in control towers and air route traffic control centers.

► Contracts totaling \$1.6 million have been let by Federal Aviation Agency for research on mobile computers working on board an Applied Physics Corp., General Precision Laboratories, Avionics Instruments Laboratory, J. M. Taylor Inc., Lear Inc., Astro Research Corp., Avtron Development Corp., Senco Corp. of America, Skoobring-Cadon and Cornell Aeronautical Laboratories.

SHORTLINES

► American Airlines reports net earnings of \$9,161,000 for the second quarter compared with \$8,167,000 for the same period in 1971. Total assets for the three months ended July 31 were last year to \$97,431,000. Total debt amounts after taxes amounted to \$6,827,000 bringing per share earnings to \$1.07 from 95 cents earned for the first half of 1971. American flew a total of 2,115,505,000 revenue passenger miles, a 7% increase, and 6,093,000 freight ton-miles, a 7% gain, during the first half.

► Chicago Helicopter Airways carried 28,182 passengers during Jan. a 12% increase over Jan. 1970. Load factor for June was 60%, compared with 56% for a comparable period last year.

► City of Geneva, Italy has approved an added expense of \$1 million to extend the road network of the city's new airport now under construction. The cost represents a 1,300 ft extension.

► Civil Aviation Board has decided after Aug. 7, by using the exchange DUDs 2 followed by the present or former number listed on Board reference sheets. The exchange DNDW 3-3111 over 5000 will be used.

► International Air Transport Asia reports member airlines carried a total of 63,249,000 passengers during 1971, a 7.5% increase over 1970. Cargo tonnage rose 21.5% and mail tonnage rose 10.1% over last year.

► Midwest Airlines earned \$1,800 per service \$ 940,000 revenue passenger miles in June compared with \$91 and 32,115 respectively over the previous June. The load factor had its best single day in June 19 when it earned 2,283 passengers en route.

► REAI, and TAA/Transcontinental S.A. will execute their combined take-over effective Sept. 1 and each country will concentrate on developing the flow of traffic through its respective U.S. gateway. Negotiations between the two airlines will continue through International Air Transport Asia-type airline operations.

► Western Air Lines board of directors has declared a regular cash dividend of 20 cents per share, payable on Aug. 14, 1972 to shareholders of record on Aug. 3. At the directors' meeting, the board was told the airline's June operating revenues were an estimated \$53 million and that the carrier had reported \$4.1 million revenue passenger miles during the month.

AT THE
TAPCO GROUP.

**Development
and production of fuel
systems and components**

